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Abstract

Social software is used widely in organizational knowledge management and professional learning. The PROLEARN network of excellence appreciates the trend of lowering the barriers between knowledge and learning management strategies for organizations and individuals. But, companies should not underestimate the needs for systematic support based on sound theories and technologies. We illustrate the requirements by examples and research issues for collaborative adaptive learning platforms for workplace learning in organizations.

1 Introduction

Social software [CKJ*06] - often connected to older forms of computer mediated communication (CMC) and newer discussion about online communities - can be defined as software that supports activities in digital social networks. Social software is becoming quite popular in organizational knowledge management. Because of the close relationship between knowledge management and professional learning, we want to investigate the use of social software in the context of the workplace and how it supports learning in that context.

Because social software was not intended specifically for professional learning, many challenges are raised by the ready acceptance of these technologies. The perceived usefulness and the perceived ease of use of social software, e.g. tagging learning resources, contrasts

with the need for efficient data structures, algorithms and interoperable infrastructures to store, maintain, and deploy learning objects on the web. Learning management systems tackle those problems by the introduction of metadata descriptions of learning objects. Also, among others, issues concerned with the quality, security, costs, and authority of learning objects are critical. We aim to explore the future evolution of social software in the context of professional learning and how this influences the further development of metadata and interoperability. Our approach is the systematic integration of social software in new collaborative adaptive learning platforms (CALP). In this paper, members of the PROLEARN Network of Excellence in Professional Training (www.prolearn-project.org) discuss different past and ongoing projects within this area and explore research issues for the topic social software which has become a new work package of the network in 2006.

The remainder of the paper is organized as follows. In section 2 we draw on the current use of social software in organisation. In section 3 we give a short introduction in the theoretical background. Section 4 gives examples from current research and creates a list of research issues. Especially evaluation and monitoring are addressed in section 5 after which we conclude and give an outlook on further activities.

2 “Blogging for Business”

Because social software was not intended specifically for professional learning, many challenges are raised by the ready acceptance of these technologies. The perceived usefulness and the perceived ease of use of social software, e.g. tagging learning resources, contrasts with the need for efficient data structures, algorithms and interoperable infrastructures to store, maintain, and deploy learning objects on the web. To highlight this argument we show here the figure Tim O'Reilly, the inventor of the term Web 2.0, used in his article [ORei05] to demonstrate the differences between traditional software concepts and business models on the one side and new companies and so-called infoware on the other side.

Web 1.0	Web 2.0
DoubleClick	Google AdSense
Ofoto	Flickr
Akamai	BitTorrent
mp3.com	Napster
Britannica Online	Wikipedia
personal websites	blogging
evite	upcoming.org and EVDB
domain name speculation	search engine optimization
page views	cost per click screen
scraping	web services

publishing	participation
content management systems	wikis
directories (taxonomy)	tagging ("folksonomy")
stickiness	syndication

Table 1: Differences between Web 1.0 and Web 2.0 (adapted from [O'Rei05])

Here, we concentrate on blogging technologies and the use of blogging for corporate communication. Successful corporate blogging programs have tended to focus on a very simple business aim. The most visible are those with a simple 'public relations' function. In the UK for example **Cadbury Schweppes** have tasked a set of "graduate recruits" in its key business areas to help get a better idea of what it's like to work for the company. In Germany, **SAP** has tasked some key executives to maintain a set of public blogged conversations to help frame a public view to their clients and partners. This level of 'senior staff' presenting the face of the company is a relatively common use for blogging in organizations [Ande05].

We discuss blogs here as an example for a class of software used now often in organizations, e.g. corporate wikis, social bookmarks, RSS web feeds [KNRT04]. One drawback of a blog is a lack of continuing input. The most popular blogs are those that receive regular updates. Their sequential nature also means that old postings are almost never revised or updated, but commented, perma-linked, and track-backed [Blood04]. The term Blog is a contraction of 'Weblog' and the act of 'Blogging' is the making of such logs (see for example: <http://www.blogger.com>). Some businesses are coming to understand that 'real' news isn't just a ticker-tape-like news feed from Reuters or the BBC. In business, the most significant news is what you and those you have reason to care about, did yesterday, are doing today, and plan to do tomorrow. This simple and high impact concept is now powering the social networks of at the heart of the new '**Web 2.0**' world. If the people you want to know about are at your work, in your supply chain, or are your customers, then business blogging is an easy way to reach them. Essentially, blogging tools and portals have become a significant focus for a trendy vision of community publishing. They allow users to quickly generate simple web pages and link to others, directly from within a public web page. In their simplest form they are used as stream-of-consciousness public web diaries or activity logs, hence 'weblogs'. They don't require expertise to use, they capture and share text easily and can even be extended to include images, sounds and movies. Members of your community can "subscribe" to blogs and upload comments to them – and even vote on the significance of the entries. In this way, this simple and yet pervasive set of tools has formed a large number of significant public "communities of practice" [Weng98] around the bottom-up drive of community members. One early corporate blogger relates how the corporate blog called 'Stuff' became a key social networking and corporate tool for the company Pyra Labs (now a part of Google).

"When new people joined our company, one of the first things folks did was read back through Stuff—all the way to the beginning. In a few hours they had a better sense of what Pyra was about than any mission statement could have hoped to communicate. We didn't need to tell anyone what our corporate values were; the spirit of the company was revealed through the posts available everyday in Stuff." (Meg Hourihan, in [Baus02])

One drawback to a blog is that a lack of continuing input, (eg. the author's creative drive dries up for whatever reason), renders the blog far less interesting to its intended audience. The most popular blogs are those that receive regular updates – personal blogs are often updated daily, but there are no rules as to how often you should post to them. Their sequential nature also

means that old postings are almost never revised or updated, but this is not such a problem as these postings are generally hidden away in an archive – still available to those who like to refer back to earlier material. Successful corporate blogging programmes have tended to focus on a very simple business aim. The most visible are those with a simple ‘public relations’ function. In the UK for example Cadbury Schweppes have tasked a set of “graduate recruits” in its key business areas to help get a better idea of what it's like to work for the company. (see <http://www.cadburyschweppes.com/EN/Careers/UKGradRec/BusinessAreas/>). The theme of presenting the company to potential recruits is one echoed in very many larger companies (see also eg. Honeywell in the US: <http://www.honeywellblogs.com/>). In Germany, SAP has tasked some key executives to maintain a set of public blogged conversations to help frame a public view to their clients and partners (see (<http://www.sap.com/community/pub/blogs.aspx>)). This level of ‘senior staff’ present the face of the company is a relatively common use for blogging in organizations [Ande05].

Blogs are generally searchable, but not as readily as static web pages, since their content is normally derived from a database on request, rather than existing as a set of static HTML pages. Blogging tools often include their own search tool, so that once you have found a blog of interest, its easy to search through its entire archive for particular key terms. In this respect, its important for the author to correctly META tag their blog so that regular web search engines can at least find its front page. There are search engines specifically aimed at the BlogSphere, such as Technorati (<http://www.technorati.com/>), who currently claim to index over 22 million blogs, where bloggers are encouraged to manually meta tag their postings. The sequential nature of a blog makes it an ideal candidate to produce an RSS data stream. RSS (Really Simple Syndication) is a format for syndicating news and the content of news-like sites, including major news sites like Wired, news-oriented community sites like Slashdot, and personal weblogs.

3 Social Exchange Theory, Reinforcement Mechanisms and Learning Networks

Breaking up the barriers between personal and professional networks has a potential added value in store for the workplace organization. Social capital theory [Gran73] supports the idea that the weak ties are important for the exchange of knowledge. One of the major features of blog is the “reputation management” of participants. Indeed, we have recently seen the emergence of so called “Ghost Blogging” services for companies who want more professional marketing and support of their blogging output. Blogs can show participants’ daily engagement with key issues. Participants can gain significant reputation in their community by “being seen” publicly creating valuable artefacts that is of use to new members of their group. The individual satisfaction and perception of effectiveness in that sense is closely related to the commitment of the individual to contribute and actively participate. Social exchange literature [DaPr98] describes four main incentive mechanisms that are relevant to motivate and encourage community members to commit and contribute to common activities, those are **personal access, personal reputation, social altruism, and tangible rewards** [HVT*05].

A main critical point in building software that is used and communities that become active learning networks [Kope06] is the engagement in the sense of active participation and contribution of the individual. The individual satisfaction and perception of effectiveness in that sense is closely related to the commitment of the individual to contribute and actively participate. Social exchange literature [DaPr99, Humm05] describes four main incentive

mechanisms that are relevant to motivate and encourage community members to commit and contribute to common activities, those are:

- personal access: in which the learner has an expectation to receive useful extra information in return for active participation
- personal reputation: the participant can improve his/her visibility and influence in the network
- social altruism: where the learner perceives the activities in the learning network and sharing with others a “public good”
- tangible rewards: where learners can negotiate and get more tangible rewards out of active participation.

Different classifications have been made between individual and interpersonal factors [DeRy85]; hard and soft rewards [Hall01]; quantitative vs. qualitative gain, intrinsic vs. extrinsic factors, and others. A question discussed about tangible rewards is the balance between individual interests and external motivation. The contribution to a public good, as tangible asset often fosters greater individual self interest by external motivation and therefore also can reduce intrinsic motivation to contribute to a network. Recent experimentation in learning networks have shown that incentive mechanisms like the adaptive introduction of extra (bonus) material based on contributions can increase both active and passive participation in learning networks [Humm05]. Beside the individual activity adaptive rewarding mechanisms [Chen05] could also take into account the current needs of the community (which contributions are currently needed, i.e. new items, rating of items, ...) and the style and quality of individual contributions in the past, i.e. less high quality contributions or more lower quality contributions in a shorter time. We perceive adaptivity and personalization as key issues for implementing mechanisms to foster and increase activities in lifelong learning networks. Currently an integrated approach that allows rewarding and incentive mechanisms on different levels of sharing and exchanges is researched in the **TENCompetence** project (see www.tencompetence.org/). A main critical point in building social software that is actually used and in developing communities that become active learning networks [KGV*05] is the engagement in the sense of active participation and contribution of the individuals.

4 Examples from ongoing Research

4.1 Automated Metadata Generation

Social software techniques enable richer capturing of context in which content has been produced. Finer granular and explicit capturing of this kind of context offers substantial potential for automating metadata production. We are integrating this sort of social software in our **Automated Metadata Generation** framework [CMDu05]. Similarly, social-software-based context capturing offers great potential to create advanced tools and services for dealing with the need for content. A rather simple example is to augment user queries with metadata that constrain results to those that are relevant to the context at hand. A more advanced example is to alert users to relevant content by automatic attention tracking, even before they are aware that it may help them in the task at hand.

Social software techniques enable richer capturing of context in which content has been produced. More subtle and explicit capturing of this kind of context offers substantial potential for automating metadata production (for instance: by reusing metadata from artefacts produced by “close neighbours” in the social network). We are integrating this sort of social software in our Automated Metadata Generation framework [CMDu05].

Similarly, social software based context capturing offers great potential to create advanced tools and services for dealing with the need for content. A rather simple example is to augment user queries with metadata that constrain results to those that are relevant to the context at hand (for instance: in a language that the user has demonstrated to master). A more advanced example is to alert users to relevant content, even before they are aware that it may help them in the task at hand (for instance: because the actions of their peers and colleagues have indicated that this content is relevant in this situation).

Our system will support dynamic multipurpose management of content, like adaptive restructuring, re-indexing (with various index sets), and alternative usage scenarios. Advanced methodologies in design education include goal based scenario, case based learning, creative problem solving, collaborative learning, learning by doing, concept mapping, and homework management.

In the future we want to make several existing learning repositories interoperable to reach a critical mass of learning resources for individualized and personalized learning. The current knowledge represented by metadata and ontologies will be enhanced to provide better and more efficient learning services. More users will generate extended usage metadata that will significantly enrich the metadata created by authors and annotators. This new metadata will provide the basis for deployment of social recommendation techniques considering learners' success. In this way we want to achieve syndication of different pools of learning objects via new services and based on open standards.

Metadata can be generated by people with various roles:

- Authors: original creators of objects can create new metadata, change existing one, specify or choose rules for automatic generation and inheritance of metadata; they can also check automatically generated metadata and adjust them
- Annotators: persons (e.g. tutors, librarians) or services (e.g. automatic indexing) adding new metadata to the existing objects; when a tutor chooses an object from a repository and includes it in his own curriculum, he may want to modify the metadata created by the original author, to match better the new context of use
- Users: people (authors, tutors, learners) generating usage metadata during the lifetime of objects; the tracking metadata (e.g. how many users have used the object, what types of users they were, how were they satisfied with the object, how successful were the learners after using the object) is a very important source of information for personalization, adaptation, and recommendation purposes; additionally this metadata provide a valuable feedback for the authors and tutors, enabling them further improvements of their learning materials and experiences [NMDu05]

The fact that various people and services can create metadata means that there can be different versions of metadata for each object. Their relevancy depends on the particular context of use.

There are two basic ways how to create metadata:

- Manual: authors, annotators, or users generate metadata by hand; commands and other facilities can be used to edit large amounts of metadata in a simple way, e.g. batch commands, visual tools

- Automatic: metadata are generated automatically by means of default values, inheritance, automatic indexing, analyzing the current context, as well as via rules specified or chosen by the authors or tutors

The metadata about context will be automatically generated and assigned to the corresponding objects. [CGGh*05] presents an approach of how to collect semantic metadata from different available contexts and activities performed by the users on their personal computers and how to further use this information to enhance and contextualize desktop search. Three important contexts are explored: electronic mail, folder hierarchies and web cache. They describe the semantics of these different contexts by appropriate ontologies and show how to extract and represent the corresponding context information as RDF metadata.

These generated metadata, either manually or automatically created, can be further used in two different ways: a) when objects are searched for, metadata about the current context is used to automatically enhance the queries; b) links among initially disconnected resources are recreated based on the contextual information, such that advanced ranking algorithms can be applied to order the search results. [CGNP05].

[CCoNP06] presents the Beagle++ desktop search prototype, which enhances conventional full-text search with semantics and ranking modules. Initial experiments show that enhancing Beagle with RDF metadata annotations significantly increases the recall, whereas adding desktop ranking further contributes with a visible improvement in terms of precision.

We recognize two basic types of metadata:

- Objective: e.g. author, creation time, size
- Subjective: e.g. difficulty, usefulness, target group; this is where alternative versions are meaningful

As knowledge communication is easier if there are various interpretations available and learners can use each of them in a flexible way, we want to improve the efficiency of learning by providing multiple perspectives of the same object. Based on the assigned metadata, learning objects can be dynamically generated and adapted according to the individual learning needs and the current context. Our learning environment will benefit from metadata and offer alternative representations and interpretations of objects. Learning delivery efficiency will be improved by adopting social filtering and recommendation techniques taking into account common user attributes and relevant metadata. Our approach takes into account the metadata, especially the usage one, and offers relevant alternatives for each object in a similar way like Google and Amazon do, considering also individual characteristics of users and their learning success. For this purpose we need a critical mass of resources, which did not have to be originally created for education, e.g. photos, videos, simulations, games, etc. Some repositories provide even geographical coordinates that brings a new dimension, which is crucial for new services, like mobile learning.

4.2 Personalization and Adaptation

Open Classroom [KKST05] is a software platform that enables real time collaboration and authentic real world learning experiences, e.g. school classes visiting a chemistry lab without leaving the classroom or meeting friends and business partners from all over the world (see <http://oc.fit.fraunhofer.de/>). The Open Classroom offers the possibility of live participation and live interaction. Photos, audio comments and video reach the classroom in real time and students there can immediately ask further questions. With the help of audio- and text-messaging students in the classroom can determine the proceedings at the field trip site. Videoconferencing enables them to interview experts without leaving the classroom.

Open Classroom is a software platform that enables real time collaboration and authentic real world learning experiences, e.g. school classes visiting a chemistry lab without leaving the classroom.

Various scenarios can be supported:

- virtual guided tours: Via internet, students and employees can explore places that were inaccessible before. Security-sensitive locations as e.g. industrial chemical labs and places of interest in far away countries are now within reach. Thus school lessons and professional training become increasingly practice oriented.
- virtual partnerships: With the help of the live interaction and videoconferencing technologies students can intensify contacts to partner classes in foreign countries and employees can get face to face with far away colleagues or customers.
- field trips: Small groups of students go to field trip sites and then collaborate live with the classroom.

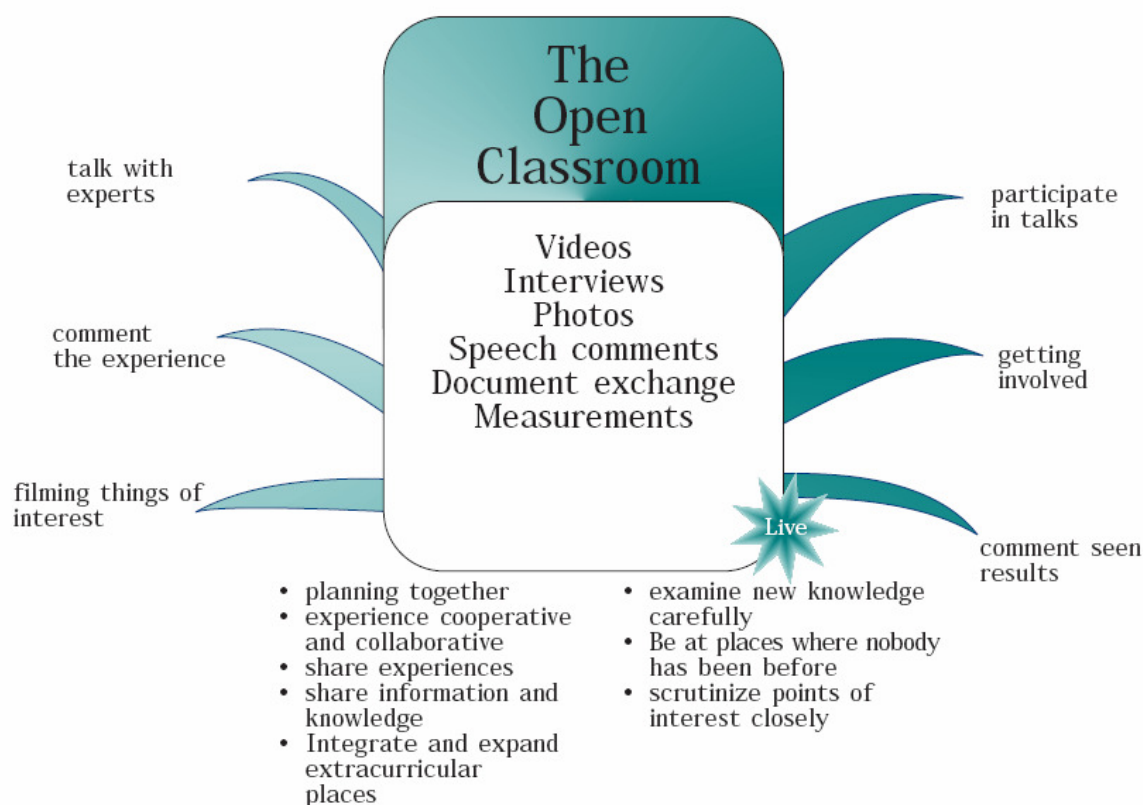


Figure 1: The Open Classroom Project

The Open Classroom offers the possibility of live participation and live interaction. Photos, audio comments and video reach the classroom in real time and students there can immediately ask further questions. With the help of audio- and text-messaging students in the classroom can determine the proceedings at the field trip site. Videoconferencing enables them to interview experts without leaving the classroom.

Using the Open Classroom Platform is very easy. The interfaces were developed for one-time users and are very intuitive. From the technical side, what is needed is just a standard browser with a flash plugin, a webcam, a headset and loudspeakers. No software must be installed and

the software is properly configured to get through your school- or company- firewalls. The Open Classroom is available for schools, companies and organisations.

In the **WINDS** [KKOp04] project university professors and their colleagues have created 21 online courses in Architecture and Engineering Design (see <http://winds.fit.fraunhofer.de/>). Our objective was to overcome the gap between pedagogues and technicians by considering the instructional requirements in the design and implementation of the learning platform. The WINDS experience shows that teachers, even without programming skills, can create web-based adaptive courses and students can benefit from the usage of these courses. According to the evaluation it seems that the WINDS environment succeeds in fostering general learning. If we want to go beyond the “no significant difference phenomenon” more attention must be paid to innovative approaches and new opportunities enabled by online instruction.

In the WINDS project the consortium partners have experimented with the Virtual University for Architecture and Engineering Design. University professors and their colleagues have created 21 online courses in this field. Their specific requirements have been taken into account in the implementation of the ALE system that integrates the functionality of a complex e-learning system with adaptive educational hypermedia on the Web. Our objective was to overcome the gap between pedagogues and technicians by considering the instructional requirements in the design and implementation of the ALE platform. The WINDS experience shows that teachers, even without programming skills, can create web-based adaptive courses (via separation of declarative and procedural knowledge) and students can benefit from the usage of these courses (especially if they complement traditional teaching). The concept map is a good example which kind of opportunity web instruction provides to enhance learning because information can be represented and accessed in different ways. Students and teachers appreciate in the web environment what they cannot find in traditional classroom. According to the evaluation it seems that WINDS environment succeeds in fostering general learning. If we want to go beyond the “no significant difference phenomenon” more attention must be paid to innovative approaches and new opportunities enabled by online instruction.

We can further build on the WINDS competence ontology, conceptual structures, metadata, and technologies. We plan to qualitatively and quantitatively enrich available contents with competence metadata, context metadata, and integrate indexing technologies to enable a new type of multi-language contents out of existing materials and external open corpus content. Efficient ways of generating metadata both manually and (semi)automatically will be employed for various types of metadata – domain, usage, competence, contextual, and social. New ontologies representing competencies, domains, and learning processes will provide a means to identify relevant learning methods and materials for the current learner and context.

4.3 Conceptual Blogging and Distributed Opinion Publication in P2P networks

The research of the KMR group (<http://kmr.nada.kth.se>) revolves around a structured information architecture called a Knowledge Manifold [Naev01a A Knowledge Manifold supports a number of different strategies for the suppression and presentation of information. It consists of a number of linked information landscapes (contexts), where one can navigate, search for, annotate and present all kinds of electronically stored information. A KM is constructed by conceptual modelling of a specific knowledge domain in order to capture its underlying thought patterns in the form of context-maps. The KMR group makes use of the KM architecture in order to construct a kind of Human Semantic Web [Naev05], which functions as a conceptual interface to the underlying (machine) Semantic Web.

A **Knowledge Manifold** (KM) supports a number of different strategies for the suppression and presentation of information. It consists of a number of linked information landscapes (contexts), where one can navigate, search for, annotate and present all kinds of electronically stored information. A KM is constructed by conceptual modeling of a specific knowledge domain in order to capture its underlying thought patterns in the form of *context-maps* constructing a kind of *Human Semantic Web* which functions as a conceptual interface to the underlying (machine) Semantic Web.

A concept browser [Naev01b] is a knowledge management tool for overview-creation and collaboration, which supports the construction, navigation, annotation and presentation of the information in a Knowledge Manifold. . A concept browser simplifies organization and presentation of electronically stored information by making it possible to investigate the content of different concepts without losing overview of their context.

Conzilla [PaNa05] is a concept browser, which aims to be an effective collaboration environment for knowledge management as well as a flexible interface for editing and presenting information on the Semantic Web. Conzilla can also be used for “conceptual blogging”, where context-maps are constructed collaboratively in different layers, with each participant in control of their own layer. This represents a very powerful way of collectively externalizing tacit knowledge.

Confolio (see www.confolio.org/) is a semantic web-based electronic portfolio system developed under the coordination of the KMR-group [NNPP05]. It is based on the infrastructure Edutella [NWQ*02] and the frameworks SCAM [PNPa04] and SHAME (<http://kmr.nada.kth.se/shame>). SCAM treats metadata in a way that is consistent with the multi-purpose, subjective view on metadata that is put forward in [NPNa02].

The Confolio system also contains a distributed opinion publication network, where each portfolio owner can publish opinions on anything that has a publicly retrievable URI, which of course is anything on the (publicly accessible part of the) Semantic Web. Although such opinions are directly visible on their “annotation target”, they are in fact controlled by the annotator and stored in her/his own Confolio. This has powerful implications on learning, as well as on social web-interactions in general, since it makes easily visible what people actually think of the resources on the web – creating what in evolutionary terms could be called a selection pressure for the enhancement of quality.

4.4 Usability & Sociability

Two major critical success factors for professional learning social software are high **usability** and good **sociability**, with each of them comprising a set of criteria and measures [Pree01]. Whereas usability is concerned with how users interact with technology, sociability is concerned with how members of a community interact with each other through the enabling technology. To produce a complete and consistent set of quality requirements for design and evaluation of social software, the critical and foremost step is to develop and document a *quality model*, which essentially consists of quality attributes, sub-attributes, criteria and metrics. Grounded in several theoretical frameworks commonly endorsed in the HCI research community [LaHv06], four key quality attributes and their sub-attributes for social software are identified: **Usability**, **Functionality**, **Interactivity**, and **Naturalness**.

- Usability
 - *Information management*: it concerns the presentation, integrity, currency and scope of information presented

- *Ease of use*: it concerns whether users can navigate the system effectively and efficiently and achieve their goals error-free and satisfactorily
- **Functionality**
 - *Interoperability*: it concerns whether the components of the system are compatible and operate seamlessly
 - *Stability*: it concerns whether the system can function reliably and predictably
- **Interactivity**
 - *Communicativity*: it concerns whether the system can support different types of communication, irrespective of the modality
 - *Responsiveness*: it concerns whether the system can heighten users' awareness to respond to situational demands, be they system-generated or user-submitted requests
- **Naturalness**
 - *Authenticity*: it concerns whether the system can support problem-oriented learning in terms of making sense of the situation with reference to perceived contextual data
 - *Presence*: it concerns whether the system can enable user to develop a sense of co-location

There are inherent social-technical gaps that seem unbridgeable [Acke00; OIOI00], especially the issue of trust that is intricately related to privacy and security. Some standardization efforts and initiatives have been undertaken [LaHv06] to address this tricky problem, but their actual impacts are yet to identify. What is still lacking is a well-defined quality model that can facilitate a development team of social software to monitor the quality level of user interface and to diagnose problems adversely influencing user experience and performance. A challenge to be addressed in the future research work. The integration of social software into the world of learning management systems and professional learning demands intensive discourses between practitioners, professionals, and scientists from different fields. There exist no standard ways to measure the above attributes, making benchmarking studies especially difficult, if not impossible. Evaluation of social software is very demanding, given the high variability in users, tasks and contexts. The extended period of interaction among multiple and dynamic user groups may render the conventional, general evaluation methods inadequate. Consequently, remote field evaluations in addition to user-based lab tests and triangulation of measures with pluralistic approaches (e.g. ethnographic method) should be deployed. We deploy cross-media social network tools within the framework of Actor-Network Theory [Lato99] for monitoring and self-monitoring purposes of the affected communities. The extended period of interaction among multiple and dynamic user groups may render the conventional, general evaluation methods inadequate. Consequently, remote field evaluations in addition to user-based lab tests and triangulation of measures with pluralistic approaches should be deployed. Digital social networks change the agency of people by the visibility of 'things', how they are created and managed and framed in discourses. The 'cow paths' in social software are results of unintended collective action. We find these paths attributed by other media (e.g. blogrolls). People are agents and/or patients in these media creating digital social networks. In professional learning, people need tools to monitor these processes, to assess the network from a structural and a content perspective. The goal is to sustain the agency of people in professional learning in complex, dynamic situations like the European Professional Learning Area. Therefore, we aim to gather and store information available in the professional learning area on different media like emails, newsletters, websites, blogs, wikis etc. in a common media base, to analyze and measure the information with cross-media social network analysis tools, and to visualize the results for the community enabling cross-media analysis of the online archives and the vivid online discourse. Design and engineering issues are targeted and cross-checked by e.g. log analysis tools and website feature analysis. We deploy cross-media social network tools for monitoring and self-monitoring purposes of the affected communities. Community members e.g. can assess the relevance of community features for their community

building and maintenance processes. Put together the underlying research question here is: How to quantify and qualify user experience in deploying social software?

5 Collaborative Adaptive Learning Platforms

These approaches lead to new **collaborative and adaptive learning platforms (CALP)** which neatly integrate elements from social software use with the need for business oriented learning management systems for professional learning. The main aims of CALP are on the one hand to achieve the highly challenging task of personalized adaptive learning. That is, to deliver quality learning resources that are tailored to the learner's needs, preferences, interests, skills, learning goals, cultural background etc. On the other hand, CALP will support knowledge sharing and community building. In CALP, we focus on personalization and collaborative work as the cornerstones of the learning process and means to improvement, performance and effectiveness. The primary goal of CALP is to connect people to people and people to the right knowledge object. CALP encompasses these elements:

- (a) Support for personal professional knowledge management using personal blogs to help people organizing and exchanging their personal knowledge and the knowledge they have acquired.
- (b) Support for co-operative learning object creation using group blogs and wikis as collaborative and effective knowledge capture systems that support learning communities in designing, creating, reviewing, commenting, modifying, and posting learning objects as support for real time collaboration and authentic learning experiences.
- (c) Support for LOM-compliant automatic metadata generation to enable indexing, storage, search, and retrieval of appropriate learning objects and learning paths relevant for a specific learner or a group of similar learners.
- (d) Support for distributed opinion publication networks and other Semantic Web technologies.
- (e) Support for access and search across content, metadata, web feeds. A learner should be able to query remote learning object repositories or blog-based distributed learning communities to quickly locate appropriate learning resources. This remote querying facility should be as transparent as possible for the users: queries sent to the own machine are automatically sent to remote repositories and the results are ranked globally and presented back to the user.
- (f) Support for personalized learning object delivery through an intelligent adaptive engine, being able to connect people to the right knowledge and deliver quality learning resources that are tailored to the learner's preferences and learning goals.
- (g) Support for personal social networks to facilitate bottom-up socialization, that is, help people build new relationships and enable them to join learning communities based on their preferences.
- (h) Support for personalized expert/community retrieval. The idea is to connect people to people through content. By searching blog-based distributed communities via metadata and web feeds and assessing the blogger's digital reputation, it is possible to identify experts inside or outside the organization with the required know-how that can help achieving better results or persons who share the same interests.

(i) Support for evaluation by quantifying and qualifying user experiences by joining HCI, social capital theory, social exchange theory and Actor-Network Theory.

(j) Social-topic networks: support for newcomers to integrate in a company. New employees are able to visualize the social networks existing inside the company, immediately find the most representative person for a certain topic and access the most important resources with respect to a certain subject.

6 Conclusions and Outlook

The PROLEARN network of excellence has recognised the obvious trend of social software use in professional learning. We have tried to illustrate the motivation for the trend and to give some theoretical background. From our experiences in previous and ongoing projects we are motivated to identify some systematic solutions for professional learning at the workplace. We sketched some key requirements for collaborative adaptive learning platforms. Evaluating such platforms by providing companies and people with tools for self-monitoring their behaviour in social networks is a great challenge. In the PROLEARN network, the work package “social software” has dedicated to tackling this issue. We will organise a series of events around the topic of social software for professional learners, aiming to bring together social software researchers and practitioners in an open space for in-depth conversations about their work, possible trends, and visions. The topics covered include business perspectives such as the potential of software tools for knowledge sharing and professional learning.

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