
FUNCTIONALITY FOR LEARNING NETWORKS: LESSONS LEARNED FROM SOCIAL WEB APPLICATIONS

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Abstract: Learning Networks are online communities for lifelong learning. How they should be designed to encourage interaction and active participation is a key issue in the development of technology intended for communities. Given the capacity of social web applications to encourage members' participation for sharing resources and creating communities, we hold that some lessons can be learned from them. In this paper we analyze the functionalities of three well-known social web applications, namely del.icio.us, Flickr and YouTube, and discuss how these functionalities can be used to encourage participants to manage, organize and regulate Learning Networks.

Keywords: Learning Networks; social web applications; functionality; del.icio.us; Flickr; YouTube

1. Introduction

Learning Networks are self-organized online communities designed to facilitate lifelong learning. In these communities learners participate actively creating and sharing activities, learning plans, resources, and experiences with peers and institutions (Koper *et al.*, 2005). These networks depend on the active participation of their members and, as a consequence, they need applications that enable and encourage participants' interaction (Koper and Specht, 2007) and, at the same time, guarantee community sustainability.

How these applications should be designed is a crucial issue in the development of technology intended for communities. Research in this area includes the exploration of social sciences theories (Kollock, 1998; Ostrom, 1990; Preece & Maloney-Krichmar, 2003) and the performance of empirical studies (Girgensohn & Lee, 2002; Leimeister *et al.*, 2004).

Outside the learning and research realms, social web applications are showing their capacity to promote and encourage members' participation for sharing resources and create communities. As their popularity (White, 2007) and social relevance (Pascu *et al.*, 2007) is continuously increasing, their integration into the educational practice is perceived as a major benefit for the next generation of eLearning communities (Downes, 2006; Keats & Schmidt, 2007; Owen *et al.*, 2006), and their social aspects noteworthy to understand community behaviour (Halvey & Keane, 2007; Lee, 2006).

Some lessons, therefore, can be derived from social web applications. Our goal in this paper is to identify their functionality in terms of community management, organization and regulation. We analyze three well-known social web applications, namely del.icio.us, Flickr and YouTube, and, based on that, we propose a set of functionalities, in terms of actions that participants can perform, to encourage and facilitate learners' interaction and community continuity. We aim at providing general guidelines to applications and platforms intended for Learning Networks.

The rest of this paper is structured as follows. The next section briefly elaborates on the concept of Learning Networks. Section 3 discusses the basic characteristics of del.icio.us, Flickr and YouTube, and section 4 presents a cluster structure to compare their functionality in terms of management, organization and regulation. Section 5, then, discusses the lessons that can be drawn from this comparison and the last section, finally, points out future work.

2. Learning Networks

Learning Networks are groups of participants and learning actions which are interconnected and supported through information and communication technologies in a manner that the network self-organises and promotes effective lifelong learning (Koper *et al.*, 2005). Participants can be, for instance, learners, teachers, tutors, providers, institutions or managers; while learning actions can be any type of resource or events that help learners to acquire a competence. Examples of learning actions are units of learning, courses, lessons, blogs, wikis, assessments, websites, or conferences in a given domain. These networks are self-directed and self-organized by participants who actively contribute by creating and sharing activities, learning plans, resources, and experiences with peers and institutions.

Issues in the design and performance of Learning Networks include how to support learners' navigation to find suitable learning actions (Hummel *et al.*, 2007; Kalz *et al.*, 2007) and how to compare and exchange those actions (Janssen *et al.*, 2007); how to foster members active contribution and participation (Berlanga *et al.*, submitted) and how to facilitate peer-support (Van Rosmalen *et al.*, 2006); how technology can support Learning Networks in an efficient manner (Vogten *et al.*, in press) and how to manage and organize such networks. In this paper we focus on the last item, the functionalities that encourage self-direction and self-organization in Learning Networks.

The design of such functionalities should take into account the following characteristics of lifelong learners (Koper & Tattersall, 2004):

- They are self-directed learners, responsible for their own learning process,
- They can participate, at the same time, in formal and informal learning actions,
- They are heterogeneous with respect to competences acquired and sought.

These characteristics imply a main change in the design of learning technologies. First, a bottom-up approach, in which participants lead Learning Networks is needed; as no institution then controls the learning process, participants are responsible for their own learning process and for organizing and directing the network. Additionally, participants can be involved in formal and informal learning actions, including role changes between those actions. For instance, in one learning action they could adopt the role of learner, but in other they could adopt the role of a tutor or a provider. Furthermore, the background, competence level and experience of the participants might vary from one to the other. Finally, as participants are interacting with several institutions, peers and learning actions, a dossier or ePortfolio that stores their competences, actions and results is needed. This will help to position and guide each participant through different learning actions.

Social web applications share several attributes with Learning Networks. The main one is the bottom-up approach. In these applications, users create and share their own resources, participate in existing communities or create their own communities. In addition, these user-driven applications have huge numbers of users; this allows participants to interact with other participants that might have different backgrounds and interests.

In order to identify promising novel functionalities for Learning Networks we decided to choose three well-known social web applications: del.icio.us, Flickr and YouTube. Our decision was based on the ability of these applications to encourage participants to share and organize resources, rather than on their ability to foster social relationships amongst participants, as in the case of MySpace, Friendster or Facebook.

3. Communities that foster interaction: del.icio.us, Flickr, and YouTube

3.1 del.icio.us: sharing bookmarks through communities

del.icio.us is a bookmark management and sharing web application. Launched in 2003, it was bought by Yahoo! in 2005. In the first quarter of 2007, 2 million of registered users were reported¹. This free-of-charge web application is a well-known example of social bookmarking. In this bottom-up approach users define keywords or tags to classify and organize their bookmarks in a non-hierarchical structure. This structure is used to retrieve bookmarks and share them amongst community members.

Apart from the obvious use of del.icio.us for personal aims, companies as well as communities and projects², are also making use of it. In educational contexts del.icio.us is used, for example, to collect references collaboratively (Mejías, 2006).

3.2 Flickr: sharing photos through communities

Flickr is a photo management and sharing web application. Launched in 2004, it was bought by Yahoo! in 2005. In 2006, 100 million photos were posted on the site and 2 million registered users were reported (Graham, 2006). It has both paid and free subscriptions. In the former, users have unlimited bandwidth to upload photos, whereas in the latter they have a limited monthly bandwidth ration. At the time this article is written (June 2007), Flickr has 3685 groups; the three most popular groups have around 40,000 members (<http://dev.nitens.org/flickr/>).

According to Marlow *et al.* (2006) Flickr is not only used for photo management tasks (organizing, contribution, sharing and retrieval), but also as a means to attract attention, to play and compete, to present oneself, and to express opinions. General speaking, Flickr is used for personal, professional, business and educational purposes. In educational contexts, its most obvious use is as a showcase platform. Libraries, universities, schools and students³ use it to show and store their photos, but also Flickr is used as an educational tool and as learning resource repository⁴.

3.3 YouTube: sharing videos through communities

YouTube is a video sharing web application, which allows users to upload and watch videos, as well as embedded them in websites, mobile devices, and blogs. Launched in 2005, it was bought by Google in 2006. In the last quarter of 2006, each day, 100 million videos were viewed and 72 million of registered users were reported (BBC News, 2006). People use this application to share personal, amateur and professional videos. Moreover, due to deals with content providers, particularly from the USA entertainment industry, channels that broadcast TV shows and programs are also available. Nowadays, YouTube is the “leading entertainment destination on the Internet”⁵, and a marketing and dissemination medium: companies, governments, and universities⁶ maintain channels in YouTube. Additionally, this application is used as a medium for distributing lessons and courses⁷.

¹ del.icio.us blog: http://blog.del.icio.us/blog/2007/03/that_was_fast.html

² For example, Adobe bookmarks <http://del.icio.us/adobe/>; EdTechTak network of educators <http://del.icio.us/edtechtalk/>; and TENCCompetence bookmarks <http://del.icio.us/TENCCompetence>.

³ For example, The American Library Association's photos http://www.flickr.com/photos/ala_members/; the Center for Experiential Learning (University of Washington) <http://www.flickr.com/photos/expatuw/>; the “classroom displays” group <http://www.flickr.com/groups/classrmdisplays/>; or the “photo students” group <http://www.flickr.com/groups/students/>.

⁴ For example, clinical cases and images <http://www.flickr.com/photos/clinicalcases/>; or <http://www.flickr.com/photos/futureofmath/>.

⁵ YouTube Fact Sheet: http://www.youtube.com/t/fact_sheet.

⁶ For example, the Google YouTube channel <http://www.youtube.com/user/google>; Downing Street channel <http://www.youtube.com/profile?user=DowningSt>; and the Open University of Catalonia channel <http://www.youtube.com/profile?user=uoc>.

⁷ For example, Math problems <http://www.youtube.com/user/mathproblems>; or guitar lessons <http://www.youtube.com/user/JustinSandercoe>.

4. Functionality for Learning Networks

As mentioned before, the success and lifespan of Learning Networks depends on their self-sustainability; they should include functionality that permits users to manage, organize and regulate resources and communities. Consequently, and considering the actions users can perform in del.icio.us, Flickr and YouTube, we cluster their functionality along three dimensions: self-management, self-organization and self-regulation.

The self-management dimension is related to functionality for administration and sharing. It includes actions that permit participants to perform tasks for creating their own profile, contacts, communities, networks, resources, and tags. These tasks are bi-directional: participants can also browse other participants' information (i.e., profiles, contacts, etc.). Table 1 shows which actions of this dimension are covered by del.icio.us, Flickr and YouTube respectively.

Table 1. Self-management functionality

Action = user create own ... / browse members'	del.icio.us	Flickr	YouTube
Profile	✓	✓	✓
Contacts	✓	✓	✓
Communities	✗	✓	✓
Resources	✓	✓	✓
Tagging	✓	✓	✓

The action *profile* means that users can create their own profile. Flickr and YouTube users can include information such as their interests (e.g., books, movies, or music), photo, gender, occupation or relationship status, whereas del.icio.us only considers the name and homepage of the user. Furthermore, in YouTube there are different types of profiles that classify a user as, for instance, guru, director, musician or partner.

The action *contacts* means that users can select or invite members to be part of their contacts by selecting current users and defining them as friends, family or, as in del.icio.us, as part of the user's network.

The action *communities* means that users can create their own communities with which to share resources and have discussion about different topics. This functionality is available in Flickr and YouTube, but not in del.icio.us. Nevertheless, the del.icio.us option "your network" permits users to connect different users in such a way that they can mutually recommend and follow up others' bookmarks. However, users cannot discuss bookmarks.

The action *resources* means that users can create and manipulate their own resources. Although this action seems obvious, it also includes resources distribution and sharing. In the three cases users can use other applications to share (blogs) and distribute resources (syndication). Moreover, in Flickr and YouTube users can use a mobile phone to upload and share photos or videos, respectively.

The action *tagging* means that users can define tags to classify their resources. In del.icio.us resources are bookmarks, in Flickr resources are photos, and in YouTube videos. This is an overlap action between the self-management dimension and the self-organization dimensions (see below). From the self-management dimension perspective, through this action users categorize their resources, explore others' resources and organize the existing ones. From the self-organization dimension perspective, as tagged resources are stored in a central repository, they are accessible from any computer and for anyone and, then, users can find out which are the resources related to a topic (e.g., <http://del.icio.us/tag/elearning>, <http://www.flickr.com/photos/tags/elearning>), to a community (e.g., PHP community <http://www.flickr.com/groups/phplang>), or to a particular user (e.g., <http://del.icio.us/TENCompetence>).

Being the self-management the first dimension, the second one is self-organization. It is related to functionality that permits users to interact and react to member's resources. This includes tasks such as commenting, recommending, copying, subscribing, adding favourites, rating, and seeing related resources. Table 2 shows which actions of this dimension are covered by del.icio.us, Flickr and YouTube.

Table 2. Self-organization functionality

Action = interaction with members' resources	del.icio.us	Flickr	YouTube
Comment	✗	✓	✓
Recommend	✓	✓	✓
Copy	✓	✗	✗
Subscribe	✓	✓	✓
Add as favourite	✗	✓	✓
Rate	✗	✗	✓
Related resources	✓	✓	✓
Search	Bookmarks del.icio.us Web	Photos Groups People	Videos

The action *comments* means that users can comment on others' resources. In Flickr and YouTube users can decide if they allow comments or not. This action is not available in del.icio.us.

The action *recommend*, which is available in all three cases, means that users can suggest a resource to someone else, whereas the action *copy*, which is available only in del.icio.us, means that users can redirect a resource to see it on their own account.

The action *subscribe* means that users can track additions into someone else's resources, tags or users. This option is available in all three cases. In del.icio.us subscriptions can be defined for tags and users, in Flickr subscriptions (called notifications) can be defined to receive an email when contacts upload new photos; and in YouTube users can subscribe to tags, to others' users video web pages (called channels), or to others' favourites videos. Moreover, YouTube users can become aware of who has subscribed to their videos.

The action *add as a favourite* means that users are able to mark someone else's resources, communities or tags, as favourites. This option is available only for resources in Flickr and YouTube. In both cases, users are aware of the popularity of their resources.

The action *rate* means that users can grade resources. Strictly speaking, this action is only available in YouTube where users can rate videos using the star system (1 to 5 stars) and the owner of the video can decide if ratings are allowed or not. In Table 2 this action is not marked either for del.icio.us or Flickr. Nonetheless, in del.icio.us, when a user saves a new bookmark, she or he receives information of how many people have saved that bookmark ("saved by"), which gives an idea of the popularity of the bookmark. In the case of Flickr, each picture shows how many people consider the picture as favourite, which also is an indication of its popularity.

The action *related resources* means that interrelated resources are showed, which is typically done through tags. Therefore, this action is associated to the self-management dimension "tagging". Although del.icio.us, Flickr and YouTube have this action, their level of interaction is different. In YouTube resources are showed in the same screen, in a form of small videos, while in del.icio.us and Flickr users have to select a tag first to see the related resources.

The action *search* means that users can look for resources, groups, people and so on. In del.icio.us users can search on their own set of bookmarks, on the whole collection of del.icio.us bookmarks, or on the

Web. Users of Flickr can search on everyone’s photos, on their own photos, on their favourite photos, and on their contacts photos. They can also search on groups (name and discussion) and on people (name or interest). Users of YouTube can only search for videos. In the three cases, search is based on free-text format.

The third dimension is the self-regulation dimension. It includes functionality that permits users to perform actions to control existing resources and communities. Table 3 shows which actions of this dimension are considered by del.icio.us, Flickr and YouTube. As the names of the actions are self-explanatory, we will not provide a detailed description of them.

Table 3. Self-regulation functionality

Action = define	del.icio.us	Flickr	YouTube
Resources as offensive	✗	✓	✓
Communities as offensive	✗	✗	✓
Private and public resources	✓	✓	✓
Private and public communities/groups	✗	✓	✓

5. Discussion

In this paper we have identified functionality of three social web applications that might help to encourage user participation and support community sustainability. Several lessons can be drawn from the analyzed functionality.

First, it is important to stress the shift away from the traditional community characterization (Kollock & Smith, 1996) that depicts communities as having well-established boundaries and a common and clear goal, as well as rules for monitoring and sanctioning mechanisms that govern the community. In social web applications there is a lack of separation between private and shared assets (Lee, 2006); the focus is on the individual rather than on the community. The individual is in control. Boundaries are not well defined as ego-centrism rules these applications (boyd, 2007; Gallant *et al.*, 2007). Learning Networks are driven by learners that interact in diverse networks but, at the same time, need to control their own learning actions, communities, and contacts. Therefore, an important functionality needed in these networks is a desktop feature (e.g., a “MyDesktop”) that allows users to control their own activity, performance and interaction with the network.

Second, the analyzed social web applications, unsurprisingly, share almost the same functionality. Consequently, as a way of capitalising the success of these applications, Learning Networks might include functionality that permits participants to perform actions along the three dimensions identified here: self-management, self-organization, and self-regulation dimensions.

The first one then includes functionality to manage and create user’s profile, contacts, communities, resources (i.e., learning actions) and tags. In our view, *profiles* or ePortfolios are not only for keeping a historical record of the actions of the participants, but also a means to present themselves to the other participants. Moreover, it is also a means for fostering interaction (Berlanga *et al.*, submitted), encouraging participation (Brouns *et al.*, 2007), developing trust (Rusman *et al.*, 2007) and promoting visibility (Girgensohn & Lee, 2002). ePortfolios should be seen more as means of self-expression than as collections of actions; more as learner-driven stories that can receive feedback from the community members (Barrett, 2006). Therefore, in Learning Networks an ePortfolio that identifies the member and contains a tracking of his/her actions should be kept and presented to the other members of the network, and tools for the creation and maintenance of ePortfolios should be available.

At this moment, there are several open questions. For instance, it is not clear if participants should keep the same self-presentation amongst all the Learning Networks they are involved in, or if different “role-plays” should be allowed. Also, it is unclear which information the profile should include, what

constitutes an appropriate level of privacy, and which characteristics and tracked actions of the participants should be included on their historical record.

Contacts in Learning Networks include, for instance, peers, teachers, tutors, institutions or even true friends (boyd, 2006). Even if the analyzed social web applications do not graphically represent contacts, it would be desirable to have such representations to support awareness and social interaction. Some examples along these lines include social browsers (Lee *et al.*, 2004) and social proxies (Erickson *et al.*, 2006). Having contacts stored using a common format, such as *Friend Of A Friend* (<http://www.foaf-project.org/>), not only makes it easier to create a view of the members of the network (Vogten *et al.*, in press) but also facilitates the exchange and the use of common information about learners' contacts.

Creating communities in Learning Networks could be done at the level of creating a Learning Network or at a lower level, creating so called ad hoc transient communities (Sloep *et al.*, 2007). These communities, which exist for a limited period of time (their transience), aim at fulfilling a particular request (their ad hoc-ness) as, for instance, peer-support (Van Rosmalen *et al.*, 2006), peer-review (e.g., learning actions), peer-advice (e.g., which Learning Network to join), or peer-collaboration (e.g., create a learning action, gather resources such as bookmarks).

Moreover, Learning Networks should have functionality that encourages members to see the activities of the rest of participants (Millen & Patterson, 2002). For instance, when YouTube users are watching a video they can also see who else is watching the same video at that time.

Learning actions in Learning Networks can be seen as the *resources* of the network. As explained before, they can be, for instance, courses, lessons, learning resources, or assessments. Participants should own their learning actions. Ideally, Learning Networks should incorporate services and tools that permit participants to create their own learning actions, modify existing ones and exchange them. Furthermore, functionality to share and distribute learning actions using different devices it is also desirable. The combination of mobile and blog functionality (De Jong *et al.*, submitted) is one approach to tackle this issue.

Tagging should not be related only to learning actions. It is also a valuable mechanism to categorize, for instance, Learning Networks, communities and contacts. This will permit participants to classify, explore and organize not only the learning actions but also the Learning Network contacts and communities.

The second dimension, defined as the self-organization dimension, includes functionality that allows users to comment, recommend, copy, subscribe, add resources as favourites, rate them, be aware of related resources, as well as functionality to search for resources, communities and people. All this functionality can be included in systems and applications that interact with Learning Networks. Participants, for instance, can comment on each other's learning actions or profiles, recommend a learning action or a contact to someone else, have a set of favourites learning actions, or rate learning actions and communities. Moreover, participants can also use searching mechanisms to look for resources, communities and people but also to visualize and browse the relationships between them.

Finally, the third dimension, the so-called self-regulation dimension, includes functionality that permits Learning Network participants to control the level of privacy of learning actions and communities as well as to decide whether they are offensive or not. For instance, authors of a learning action can define who can modify the action, if it is available to anyone, or if it can be rated or assessed by others. Moreover, authors of a Learning Network can define who can join the community, modify its characteristics, or add learning actions.

6. Conclusion and future work

In this paper we have identified novel functionalities for Learning Networks. Our proposal, which is based on the analysis of the functionality of social web applications, attempts to define the key actions participants must be able to perform in order to manage, organize and regulate Learning Networks. Some of the functionality identified in this paper has already been implemented in the Personal Competence Manager (Vogten *et al.*, in press). This infrastructure, which aims at supporting lifelong learning through

Learning Networks, currently includes the actions “communities” and “resources” (self-management dimension); “rate” (self-organization dimension); “private and public resources” and “private and public communities/groups” (self-regulation dimension). Future work will study how the whole set of functionalities described in this paper can be incorporated in this infrastructure and explore how their impact can be measured.

Furthermore, the functionalities identified in this paper provide some clues to design applications and tools aimed at creating, sharing and assessing ePortfolios from a learner-centred perspective.

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