

SOCIAL MECHANISMS TO MOTIVATE LEARNING WITH REMOTE EXPERIMENTS

Design Choices to Foster Online Peer-based Learning

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Abstract: If we consider knowledge to be the result of a negotiation process about references and meaning between individuals, then, we should consider it also a collective or social property. This view underlies numerous initiatives worldwide providing unrestricted online access to educational content, software tools, and implementation resources, commonly referred to as Open Educational Resources (OER). In earlier research on the use of Open Educational Resources at the TU Delft, we addressed the issue of sustainability of OER projects in terms of organization, motivation, types of resources, types of reuse, and funding and revenue models. In this paper, we focus on how social mechanisms can contribute to increase motivation amongst stakeholders to maintain and create useful content, and engage in meaningful interactions within learning communities.

1 INTRODUCTION

The UN Declaration of Human Rights declares universal access to education (United Nations General Assembly 1948). Publishing educational resources on the Web increases access to learning materials to those that have Internet access. Still, the provision of educational resources is not the same as education. Education is more than a Powerpoint presentation, syllabus, or reading list. It includes structured guidance and feedback, mentoring, assessment, building relationships, and in most cases accreditation. There is a gap between this conceptualization of education and the current OER-projects where courseware is shared online for free.

Lately, we have seen initiatives that add pedagogical support and tools to support interaction and communication between peers about content (Downes 2008). Social software is used to move online learning from consumption of information to co-creation, peer-production, and communication about learning resources. Examples, including commercial ones, are Learnhub, NIXTY, P2PU (Peer-to-Peer University), WatchKnow, and Curriki.

In 2008, an EU-initiative called LiLa started. “LiLa” is the acronym for the “Library of Labs”, an initiative of eight universities and three enterprises,

for the mutual exchange of and access to virtual laboratories (simulation environments) and remote experiments (real laboratories which are remotely controlled via the internet). LiLa builds a portal, which grants the access to virtual labs and remote experiments. It includes services like a scheduling system, connection to library resources, a tutoring system, and an authoring tool. Moreover, LiLa creates an organizational framework for the exchange of experiments between institutions and for the access to experimental setups. Supporting this, LiLa provides contract templates for institutions and didactical help for lecturers for the integration of remote and virtual experiments into curricula. Primary target groups of LiLa are university teachers and their students in undergraduate and graduate classes of the natural sciences and engineering. In this paper, we will highlight the design choices of LiLa from the perspective of motivating meaningful interactions and learning with LiLa.

2 LEARNING IN ONLINE ENVIRONMENTS

In community-oriented learning environments, learning relies on voluntary participation of

members of the environment. In these environments, peer-support and guidance should be supported and encouraged. Through social software, intuitive design, and intelligent support, learning from remote experiments and virtual laboratories can (and should) happen between students online. What we give here is a framework that describes how social mechanisms influence the behaviour of students and teachers who are using and contributing to LiLa.

According to constructivist learning theories, humans construct knowledge and meaning from experience (Vygotsky & Cole 1978; Bruner 1991; Piaget & Cook 1952). Personal development and deep understanding happens through the construction of meaning by the learner self, not through transmission from one person (the teacher) to another (the learner). The fundamental principle of constructivism is that learners actively construct knowledge through interactions with their environment (Hout-Wolters et al. 2000; Rieber 1996).

The central point of social-constructivism is an individual's making meaning of knowledge within a social context (Vygotsky & Cole 1978). Learning as a social practice is well established and dialogue is one of the corner stones of social constructivism. This makes online communities such potentially effective places for learning, because it allows for both synchronous and asynchronous interactions through a number of modalities. The drawback is that the online environment is not similar to face-to-face environments in terms of trust and interaction. Interactions in online communities are maintained through a sense of community and social capital through information flow, altruism, reciprocity, collective action, identities, and solidarity (McLure-Wasko & Faraj 2005; Kollock 1999; Bouman et al. 2007; Ackerman et al. 2004). These are central elements that need attention in an online social learning context. Social mechanisms that address internal cohesion and sense of community are important for learning and overall sustainability of a social learning environment, and so are mechanisms that impact interaction with the external environment (Hennis & Kolschoten 2010), including reputation and recognition.

Furthermore, learning is situated, which means that it is located in the process of co-participation and in the field of social interaction, not in the head of individuals to get an inter-subjective understanding and meaning of something (Lave & Wenger 1991). In communities, learning means moving from the peripheral (lurking, being introduced into processes, people, etc) into the

center (sharing expertise, making decisions). Peripheral participants do not accumulate knowledge and skills but are introduced in processes, routines, networks, relevant issues, and approaches within the community (Allert 2004).

Learning as knowledge creation is seen as analogous to processes of inquiry, especially to innovative processes of inquiry where something new is created and the initial knowledge is either substantially enriched or significantly transformed during the process (Paavola et al. 2004). Hence, learning goes beyond the information given and engages the learner to participate and contribute. This type of learning comprises of open, ill-structured problem solving processes, focuses on communication and collaboration. Stahl emphasizes that meaning is collaboratively produced in a cultural context, embodied in a physical or semantic artefact, and is situationally interpreted within a community or social system (Stahl 2003). Meaning is not transferred from one thinker to another, but is constructed.

New developments in the science of learning also emphasize the importance of helping people take control of their own learning. Since understanding is viewed as important, people must learn to recognize when they understand and when they need more information. Effective learning environments therefore focus on sense-making, self-assessment, and reflection on what worked and what needs improving (Stahl 2003; Paris & Winograd 2003; Stahl et al. 1999; Siemens 2005).

We understand learning as a lifelong, self-directed and collaborative effort, in which one engages with people and finds resources online. Educational technology and institutions should focus on supporting this process, and guide students in assessing and evaluating knowledge they encounter online. Rather than individual learning based on competition and hierarchy, a more networked model of learning is preferred, because it allows learning from peers, and stimulates cooperation, partnering, and mediation (Davidson & Goldberg 2009). The ingredients of the Networked Learning model are four complementary areas that play an important role in knowledge development (Veen et al. 2008). Each of the elements that are connected to these areas is relevant for this development process in which the technology is a major facilitator for processes of communication, information retrieval and information sharing. These areas are: Profiling, Connectedness, Knowledge and Business Development. Networked learning focuses on interconnectedness between people and between

people and resources (Veldhuis-Diermanse et al. 2006; Laat & Lally 2003; Vries 2008; Laat 2006). Technology is used to integrate delivery of knowledge with interaction, communication and application (Jones & Steeples 2001). The earlier mentioned concept of Communities of Practice (Wenger 2000) is integrated in Networked Learning, because learning practices and social practices are interconnected, the learning practices emerge from participants rather than be imposed by facilitators, learners are involved in concrete practical actions together, learning is not designed, rather designed for, variation in levels of expertise can expand the group's learning, networked learning needs to support visits to "otherness" (Paavola et al. 2004).

The above describes adequately the learning philosophy and design approach for In the following, we describe social mechanisms that can be addressed in order to increase motivation to participate in Open Educational Resources (OER) projects like LiLa.

3 SOCIAL MECHANISMS OF THE LILA PORTAL TO FOSTER MOTIVATION

We have applied this framework into the design of processes and technology of the EU-funded project called LiLa, Library of Labs. The portal disseminates and aggregates remote experiments, learning resources (including assignments), and lessons. A lesson is a set of learning activities that contain LiLa content, such as experiments and learning resources.

One of the most important things in the design of an online community is its alignment with the interests of the intended participants, and the collective characteristics of the community (Preece & Maloney-Krichmar 2003; Preece & Maloney-Krichmar 2005). A person only contributes when this effort helps to satisfy a need (i.e. psychological needs) (Kollock 1999). If a person perceives as if a technology brings personal benefit, participation will be more likely (Pearson 2007; Rashid et al. 2006; Garfield 2006). It is therefore required to know the problems and objectives of (future) users. When potential users and contributors can relate this to their own needs, there is higher probability of participation (Preece & Maloney-Krichmar 2003). The primary audience of LiLa consists of university teachers and students. In an internal review of pedagogical scenarios amongst 5 European

universities, we identified different scenarios regarding the use of experiments. The use of experiments in education ranges from teacher-centered education to student-led education. A whole range of learning scenarios can be thought of within the two ends of the spectrum. The strategy we chose to accommodate the different learning scenarios is by offering tools that support both teacher- and student-led learning, like SCORM compliancy and peer assessment. Next to "consumers" of LiLa content, we have the content providers, who are the institutes and individual experiment owners (teachers etc.) who potentially want to share their remote experiments online. The same motivations for people to share OER (Hylén 2006) seem to apply to remote experiments.

Leaders in online communities can be important for the success of the community. In addition, leadership is an enabler for knowledge sharing (Ardichvili 2008). Leaders support and engage people, form connections, discuss strategies, choose content and technology, and show exemplary behaviour (Koh et al. 2007; Wenger et al. 2002). LiLa members have a personal page where they can add their field of expertise. In addition, users can indicate their role as a student or teacher. This information is used to tweak the portal's interface based on the role of a user.

With regards to organization, sustainable online communities should offer services along four dimensions: self-management (facilitation of creation and management of presence and resources), self-organization (facilitate interaction and knowledge construction), self-categorization (support classification and evaluation of contributions), and self-regulation (offer tools to manage privacy and spam) (Berlanga et al. 2009). For reasons of sustainability, the design of LiLa focuses on the decentralization of adding, managing, and learning from LiLa content.

Uniqueness and social comparison can encourage participation and sharing of information (Ludford et al. 2004; Chen et al. 2009). Generally speaking, heterogeneity is an important factor for knowledge creation in online communities. In order to bring together different perspectives, there has to be an open dialogue, and different levels of participation must be accepted. Large and small contributions (such as comments) are needed to sustain and create new interaction. Because true membership grows over time and with interactions, passive members may over time become active and engaged (Berlanga et al. 2009; Wenger et al. 2002). It also means that different people must be addressed

in different ways (Kollock 1999). The LiLa portal allows to design collaborative assignments that require input from different disciplines. Also, heterogeneity is accommodated in the metadata, which allows for translation of content.

We mentioned relevancy as requirements for an online community to become successful. One important incentive for people to join and participate in learning communities, is of course, their ability to help you learn something (Bouman et al. 2007). Learning can relate with heterogeneity in expertise, support for questions, and getting useful recommendations (automatic and social). Another essential motivation for people to join online communities is networking. Networking leads to new trust relationships and collaboration. It is especially effective when online and offline interactions reinforce each other (Koh et al. 2007; Wenger et al. 2002). Relationships are established through social presence, empathy, and trust, possibly by means of community managers or moderators (Preece & Maloney-Krichmar 2003). Learning is the core of LiLa. To support online learning, we have developed a number of tools, including recommending technologies, rating and peer-support through forums and a specialized tutoring system to support learners during learning activities. Also, automatic emails are sent that contain interesting contributions and comments on content one follows. Students and teachers will only keep on visiting LiLa, if they benefit from it. The benefits may relate with learning, but an important incentive for OER providers is also the ability to connect with peers and get feedback. Online, you are able to follow persons, so if someone you find interesting adds a new resource, you will be notified. Offline, we organize several meetings and visit conferences to increase and improve the LiLa network.

Reputation relates to the concept of online identity and trust and is a primary research focus in Web science. Overview of past actions and participant identification helps to create and sustain trust relationships in communities (Moore & Serva 2007). Trust forms the basis of a relationship and is one of the most important enablers of community participation (Ardichvili 2008) and sharing knowledge (Lee 2008). Reputation is used as virtual currency (World of Warcraft), can be a conduit for trust (eBay), and the information stored in reputation profiles is used for recommendations of people and content. Howard Rheingold describes status, recognition or prestige as a key motivation of individuals' contributions to the group (Rheingold 1993). This is especially true in knowledge-sharing

communities, and forms an important motivation for people to contribute (Lampel & Bhalla 2007; Pearson 2007). Recognition satisfies a person's need for self-esteem, as depicted in Maslow's hierarchy of needs (Kollock 1999). People tend to contribute knowledge when it enhances their professional reputations (McLure-Wasko et al. 2009; McLure-Wasko & Faraj 2005). Increased recognition also supports identity building and belonging (Bouman et al. 2007). Visibility of contributions is similarly important: if people see their contributions being used and re-shared, they are more inclined to share more information, especially when there is some recognition or praise or encouragement (Endres et al. 2007). We suggested a reputation architecture that motivates individuals to be engaged in processes that ultimately contribute to the sustainability of the portal. For LiLa, we argue that these include organizational processes of quality management, contribution and aggregation of content, creation of knowledge, and managing discussions. Also, helping out people with questions and providing feedback on requests are attributed. The reputation architecture monitors the interactions and contributions, and creates human readable profiles of someone's online activity on the portal. The interpretation of this activity can be done by teachers, students, or others, and will depend on the objectives for interpretation.

In addition to reputation, there is reciprocity, the social norm that describes the expectation of people to respond to each other in kind, both in a positive and negative sense. People expect something to get in return from others. Even though reciprocity is not always an essential element (McLure-Wasko & Faraj 2005b), many online communities and social network sites encourage reciprocity with rewards and acknowledge helpful responses (Preece & Maloney-Krichmar 2003). We have suggested a feedback tool for teachers to share their experiences on experiments and pedagogy. Students can ask questions and engage in discussions about theoretical or practical issues. Registered LiLa members are notified of changes and new discussions, responses, and added content. If someone posts a question, he or she expects to get a response in time. Hence, each person has a personal Watchlist, and is notified through e-mail with a weekly digest of what happened on LiLa.

In many online communities, most activity comes from of a small core group of experienced people. It can be difficult for newcomers to participate and to have enough confidence to contribute (self-efficacy, see next paragraph). Newcomers, therefore, should be treated carefully

and given considerable attention. When people signup, in LiLa we ask for some information, including background and affiliation. Using the affiliation of a person, we can connect newcomers with active members and other newcomers, making newcomers more comfortable.

The perception people have about themselves and their ability to perform a specific task is called self-efficacy. Self-efficacy is the central cognitive mediator of the motivational process (Bandura 1997). In other words, if a person does not have a positive perception about his or her ability to do or contribute something, the (s)he will not do it. This also applies to knowledge sharing (Endres et al. 2007). LiLa members must be able to contribute in small, easy steps. For example, adding a comment is very easy, and can give someone the confidence of starting a discussion, or reviewing a solution. Additionally, users can simply indicate that they find a resource, comment or experiment useful. When people get positive feedback, and are recognized for their contributions, they are more likely to contribute.

4 CONCLUSIONS

In this paper, we elaborate on our design of the Library of Labs (LiLa) using a number of social mechanisms, defined in an earlier study as to support motivation of individuals in online knowledge environments. The framework supports designing for motivation by focusing on social and psychological factors that influence the way people behave and share information online.

In projects where Open Educational Resources must continuously be contributed, created, updated, managed, reliance on a central authority is costly and sometimes not feasible. We linked this problem with current approaches on learning, which address a more active, creative, and conversational way of learning. In addition to support for individuals to connect, discuss, assess and create learning materials, an OER project must also address their motivation to communicate, collaborate and learn. With social mechanisms, we can look for solutions and support our design choices.

In our further research on LiLa, we are going to focus on evaluating and merging individual social mechanisms. Evaluating the use of the portal and the behavior of the users will become a crucial part of the online environment itself and thus an additional functionality to foster motivation with providing feedback to the users.

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