

# **Social learning in Learning Networks through peer support: research findings and pitfalls**

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## **Abstract**

Learning Networks are particularly suitable for lifelong learners as Learning Networks are online social networks designed to support non-formal learning. Lifelong learners want to learn what they need, when they need it and at a place and pace that suits them. Combined with the heterogeneous background of the learners, it is very hard to meet these needs with traditional curriculum based formal education. Instead the learner needs to be put central. Moreover, learners in a LN need to rely on learning through and with others, by sharing knowledge. That this is a feasible option is shown by the positive effects of collaborative learning and peer tutoring in formal education, as well as the interest in social learning in the digital era. However, a Learning Network needs to provide learner support services to tackle obstacles that arise due to the lack of interaction structures and organisational structures that come naturally with a formal educational setting. A peer support service that assists learners in finding the most suitable peer for their request is one of the required learner support services. In this paper we argue why social learning and peer support are relevant to learners in a Learning Network. We describe our peer support model based on the notion of ad hoc transient groups and present findings of five empirical studies that used prototypical implementations of this model. In the first prototypes peer selection criteria focused on content knowledge, proximity or eligibility and past workload. As collaboration tools, a wiki, discussion forums or instant messaging were used. In three studies, both formal education and in Learning Network conditions, the peer support systems were successful in that selected peers provided decent answers. However in two other studies we encountered problems. In one study learners failed to use the peer support systems to ask questions. In another study, sufficient participants were recruited beforehand, but many never responded when the experiment started. As a consequence, peers who were paired with learners never showed up and learners got frustrated. This shows how important it is that learner support services not only provide the means to interact with others but also provide the affordances that stimulate and motivate the learners to engage in meaningful interactions.

## **Keywords**

Learning Networks, social learning, peer support services, selecting suitable peers

## **Case - Janet - a patent lawyer**

Janet is a lawyer who specialised in patents. After she graduated from law school she entered a position as lawyer at a large pharmaceutical company. She needs to deal with the patents concerning new medicines. Although she competently deals with the legal aspects, she starts realising that she does not know what the patents are about, what disease the medicine is developed for, etc. She perceives this as a drawback when communicating with her colleagues. She decides she needs to get to know the basics about pharmacy and molecular biology, not to become an expert but to be able to follow what her colleagues are talking about. She can't resort to following a formal medical study as she has a full-time job. For Janet it would be most effective when she could join a Learning Network that provides her with access to people to whom she can direct her questions.

## **Introduction**

The case described above is a good example of the type of learning that can best be met by a Learning Network. In Janet's case the initial education did not fully prepare her for her current job requirements. However, she also is not in the position to return to university and follow another fulltime study. Not only is that very hard to combine with her job and family life, but it would be also overkill. After all, she does not aspire to become a

qualified microbiologist, but only wants to get to know the basics. She could try to find some written resources, books, documents etc, but it is far more likely she would obtain the knowledge she required more directly and efficiently from consulting colleagues working in the field. And she would like to do that a time, place and pace that suit her. This logistic and content flexibility is something that can't be covered in traditional educational settings (Sloep, 2009b). Instead, new forms of learning and new settings are required. Learning Networks provide for this as they consist of online social networks and are designed to support this kind of non-formal learning, meeting the demand for logistic and content flexibility, and providing services and facilities to support learning through knowledge sharing. The main characteristic of Learning Networks are the social, community aspects where individual learning goals are obtained in a social context through interaction and collaboration with others and where the goal of the collective is required to maintain the Learning Network (Sloep, 2009a; Sloep, 2009b). The Learning Network as a whole benefits from strengthening the weak ties (Granovetter, 1973; Levin & Cross, 2004; Nardi, Whittaker, & Schwarz, 2000), connecting people who have no connections to bring in new knowledge, while knowledge sharing can benefit from strong ties between people who already established trust (Plickert, Côté, & Wellman, 2007).

In this paper we present our model for a peer support systems to promote and enhance knowledge sharing in Learning Networks. We will also illustrate that verifying this model in practice, in particular in Learning Network conditions is difficult, even when carefully designing experiments. The remainder of the paper is structured as follows. In the next section, we briefly explain why knowledge sharing and social learning is important in Learning Networks. In section 3 we introduce our notion of ad hoc transient groups as underlying mechanism for peer support systems in Learning Networks. Section 4 describes some of the prototypical peer support systems we implemented and the results we obtained when testing those. Finally we draw some conclusions for future work.

## Social learning in Learning Networks

Participants in Learning Networks learn by sharing knowledge through interaction with others. Through this collaborative process learners can obtain mutual understanding and build knowledge (Hsiao, Brouns, Kester, & Sloep, 2011; Kester, van Rosmalen, et al., 2007). Although learners can find part of the required knowledge in learning material and content, learning is an inherently social process; it takes place in a social context, and people learn from and by others. Even when an individual starts by learning from existing explicit resources, at some point this is not sufficient and the individual learning process stagnates. At this point, the person has to call on others in order to complete the knowledge acquisition and learning process. The learner has to make the problem known to others so they can work together in small groups to negotiate common understanding. And finally the results have to be fed back to the Learning Network to close the cycle (Stahl, 2006). In formal education, the teacher guides the necessary interactions by using relevant instructional methods. For example, collaborative learning and peer tutoring are used to structure student-student interactions and to stimulate students to discuss their learning and negotiate meaning. Various studies have shown positive effects of collaborative learning, peer tutoring and social learning, mostly in traditional educational settings - including online environments (Bronack, Riedl, & Tashner, 2006; Dawson, 2008; Dillenbourg, 1999; Fantuzzo, Riggio, Connelly, & Dimeff, 1989; Stodel, Thompson, & MacDonald, 2006; Vassileva, 2008; Wiley & Edwards, 2002), but also in organisational settings (Lave, 1991; Marsick, Watkins, Callahan, & Volpe, 2006). Learners benefit in two ways by collaboration in social settings, firstly because it improves learning outcome by reducing isolation, providing a sense of belonging, being able to make use of the collective intelligence. Secondly, because helping others is in fact 'learning twice' and valuable in itself (see Sloep & Kester, 2009).

While studies in online and distance education have shown that carefully designing opportunities for social interactions can promote collaboration and cooperation (Dillenbourg, 1999; Thurston, 2005), most of the times these methods work well because they are implemented in formal educational settings where there is a teacher to carefully design the learning material, tasks, the situations and the interaction structures to promote interactions. Even when these exist students in online education environments still can perceive a lack of social structure, and do not feel part of the group of fellow students and do not feel they belong (Dawson, 2008; Thurston, 2005). Learners who do not feel part of the community do not feel engaged or committed to the group and thus they are not inclined to initiate interactions. Lack of interactions and reluctance to engage in social interactions can result in isolation of learners that in turn has negative effects on learning outcomes (Rovai, 2002; Wegerif, Mercer, & Dawes, 1998).

This means that there are several reasons why a Learning Network has to provide a 'social support system' that assists learners in initiating and maintaining social interactions with the most suitable peers and social structures that are conducive to knowledge sharing and construction (Kester, Sloep, et al., 2007). As shown above, learners has to experience a sense of belonging, feel part of a community before engaging in interactions that come naturally in communities and Learning Networks should take on these community aspects. According to Wenger et al (2002), learning communities are groups of people who acquire new knowledge through cooperation and collaboration. To meet with success, a learning community depends on its social space, its member characteristics, and the characteristics of the community as a whole. An effective social space is characterised by affective work relationships, strong group cohesiveness, trust, respect, belonging and satisfaction (Kreijns, 2004; Nichani, 2001; Rovai, 2002). Through social interaction social spaces emerge. Kester and colleagues (Kester & Sloep, 2009; Kester, Sloep, et al., 2007) distinguish three main conditions that have to be met before knowledge sharing will arise. For social interaction, in particular cooperation to occur and for social embedding, there should be continuity (it must be possible and likely for people to meet again in future), recognisability (people should be able to recognise each other), and history (people should know the past behaviour of the other participants). If these conditions are not met, people are more prone to act selfishly, because they can't be held accountable for their actions (Erickson, Halverson, Kellogg, Laff, & Wolf, 2002; Kollock & Smith, 1996 ). Accountability is an important element in trust formation between group members (Rusman, Van Bruggen, Sloep, & Koper, 2010). Moreover, there should be a clear goal and a clear set of rules to abide by (boundary condition); and the group population should be heterogeneous and contain novices, experts, lurkers, active participants to assure liveliness (heterogeneity condition) (Preece, Nonneke, & Andrews, 2004).

Just providing the means to collaborate, does not mean learners will actually engage in the required interactions. There is ample research on what motivates people to contribute or participate. Researchers looked at psychology and community behaviour reviews for theories to explain users' behaviour in communities and mechanisms to enhance contributions and participation. Social exchange theory is often mentioned as a theoretical framework for community behaviour, as are the positive effects of visualising users and their actions on participation (Millen & Patterson, 2002). Ling et al. (2005) were able to confirm that people would contribute more when the system showed them how unique they and their contributions were, and when they set specific goals to attain. These aspects are captured in the conditions we mentioned above (accountability, boundary, recognisability, continuity and history). Intrinsic (altruism, reputation) and extrinsic motivations (rewards, personal needs) (Lui, Lang, & Kwok, 2002) also play a role. Although these are inherently present in Learning Networks: in the short-term goal of helping and the long-term goal of reaching one's learning goal, these might be less obvious to the learner and need to be made explicit.

From an instructional design perspective, cognitive load also can affect contribution and participation in knowledge sharing. Cognitive load is used as indication of how much mental processing and mental effort a person needs to expend in performing a certain task. Rather than being an indication of difficulty, it indicates how much mental processing is involved. The aim of instructional design is to optimize cognitive load as much as possible by reducing aspects of the design that result in unnecessary processing and by increasing processes that contribute towards learning. (Sweller, Van Merriënboer, & Paas, 1998). Cognitive load is also used as measure to evaluate the usability of a computer application (see e.g. (Hollender, Hofmann, Deneke, & Schmitz, 2010) or in our case the peer support system in Learning Networks.

## **Ad hoc transient groups**

Large networks, that allow sub-communities to arise such that a few community members get together to address a specific goal, are usually more effective (Lui, Lang, & Kwok, 2002). This principle is captured by our notion of ad hoc transient groups: small groups in the larger network formed to obtain a specific learning related goal that cease to exist when the goal is reached. When we bring small groups of learners together around a specific well-defined topic, this would allow the participants to work at the issue and solve the problem. While doing so, they improve their knowledge, but also get to know new people, forging new relations and ties. Once the issue is tackled, the group dissolves, but relations and ties can continue in the network. When these ad hoc transient groups are formed frequently enough, they could promote the formation of relations in the Learning Network, increase sociability, turn weak ties into strong ties enhancing knowledge sharing, and improve network structure. At the same time, learners get assistance in performing learning activities while pursuing their ultimate learning goal (Kester & Sloep, 2009).

The generic model contains five phases, of which the first three steps - creating a request, defining its context, identifying suitable peer tutors - are required to determine the context of the request. The actual support request is dealt with in the last two steps: creating the answer and receiving the answer (Brouns, Fetter, & Van Rosmalen, 2009; van Rosmalen, Sloep, Kester, et al., 2008).

Whether this is effective depends very much on the selection of the most suitable peers who are deemed suitable to provide the required support. The peer selection criteria very much depend on the context of the support request. In the context of learning, the main criteria are content knowledge, proximity or eligibility, tutoring competence and availability. It seems obvious that the peers at least have some knowledge about the subject of the question. Although peers not necessarily need to be more competent than the person asking the question (King, Staffieri, & Adelgais, 1998), peers at similar levels of expertise use more concrete statements, because they are within each other's Zone of Proximal Development (Vygotsky, 1978), while more experienced peers approach the goal at a more abstract level (Hinds, Patterson, & Pfeffer, 2001). Tutoring competence indicates how well a peer is able to help the learner. Availability reflects calendar availability as well as past workload. The exact implementation of the selection criteria is still under investigation, but will vary with the purpose of the Learning Network.

## Research findings

To verify our model and test selection algorithms we implemented the model in several modules. All studies applied the same generic peer support model: finding a suitable peer to assist a learner. Our Learning Network on Basic Internet skills has been used repeatedly in our studies and turned out to be a good subject to recruit participants. The Learning Network covered a variety of topics all related to using the World Wide Web. For each of these topics, reading and learning material was provided. In each of the empirical studies a new Learning Network based was set up. Materials were revised and new participants were recruited. The Learning Network has been used for the ATL (A Tutor Locator) study, one of the SAPS (Synchronous Allocated Peer Support) studies, as well as for a study on cognitive load. Other studies were conducted in higher education or used existing networks. Details are provided with the study.

### ATL: A Tutor Locator

ATL was developed to reduce staff tutor load by involving peers in answering content-related questions (van Rosmalen et al., 2006; van Rosmalen, Sloep, Kester, et al., 2008; van Rosmalen, Sloep, Brouns, et al., 2008). Furthermore the system had access to learner progress and subject mastery data. ATL was applied in the Learning Network on Basic Internet skills, and was developed as add-on to Moodle. It consisted of a form where learners could formulate a question. Latent semantic analysis (LSA) was used to determine to what topic the question most likely referred. Peers were selected based on their subject mastery and their similarity in progress to the learner asking the question. In addition, availability and past workload were taken into account. Past workload indicated how many support requests the peer had performed as compared to the average of the whole group. Peers were invited by e-mail to assist a learner with a particular question. After at least one suitable peer accepted the invitation, the learner and peers got access to a wiki to formulate the answer. To assist them, the system provided three text fragments in the wiki that originated from the learning material. These fragments were located using LSA and likely contained the (part of the) answer. When peers were selecting using all criteria instead of only considering availability, more questions were answered in a shorter time span. Both learners and experts indicated that answers were of good quality. Participants liked the peer support and would like to have access to a similar system in future learning situations.

### Synchronous Allocated Peer Support

De Bakker (de Bakker, 2010; De Bakker, van Bruggen, Sloep, & Jochems, 2011) investigated the use of synchronous communication in a peer support system and applied it both to formal education and a Learning Network on Basic Internet skills. For the formal education situation a stand-alone client was developed, the system applied to the Learning Network consisted of a Moodle add-on. The system dealt with course-related questions, and learners had to indicate what type the question was, e.g. theoretical, organisational. Selection of suitable peers was based on subject mastery and proximity. In addition, learners indicated what kind of question they considered themselves competent in. Two economy criteria were added: peers who had not assisted as much were prioritised as well as learners who asked many questions. Results were quite positive. Although experts rated quality of teachers' answers higher and students rated teachers' answers better, a fair proportion of questions could be satisfactorily answered by the peers. Moreover, the studies did not find any difference on test

performance. Students liked the system and were more likely to ask questions to peers than to teachers. However, it seemed that spreading the load by applying the economy principles reduced quality of answers. This warrants further research.

### **Ask your question at TeLLNet**

TeLLNet is a large teacher community as part of European Schoolnet. Teachers use it to find other teachers to conduct projects with. A peer support system was implemented to assist them (Fetter, Berlanga, & Sloep, 2010). As learning goals and progress were absent in this system different peer selection criteria had to be applied. For all participants there was information on which languages they master, which subjects they teach and are interested in. The scope of questions was limited to questions about TeLLNet, selected subjects or project-related questions. A subset of subjects was selected and only four languages were supported. Peers were selected based on similarity in subjects and language. Teaching experience, number of projects and time involved in the TeLLNet project and past contributions were taken into account. This study only recently finished and analysis is ongoing. Preliminary results are positive. Questions were asked and answers provided.

### **Cognitive load in finding suitable peers**

Two studies were conducted to investigate whether a peer support system that selects suitable peers could alleviate unnecessary cognitive load. The first study used a modified ATL system in the Learning Network on Basic Internet skills. One group of participants had access to the ATL system, but peers were selected based on past workload only. Another group of learners had access to a traditional discussion forum. To stimulate knowledge sharing, additional tasks were added to the material. A sufficient number of participants were recruited: every group consisted of around 90 learners. However, only about 20 learners actively participated. Even less participants submitted the cognitive load measurement. Remarkably hardly any questions were asked, neither in the forum (16) nor in the ATL system (9). Replies were formulated to only 9 of the questions posted in the forum and in merely 6 cases a valid answer was provided. Responses in the ATL system were even worse, as only in 3 cases peers accepted the invitation to assist and one valid answer was given (Hsiao, Brouns, & Sloep, 2010).

It was rather surprising that so few questions were asked, because in previous studies using the same Learning Network over 100 questions had been asked. On the other hand, in the evaluation questionnaire, participants indicated that the learning material was easy and did not require assistance from others. Although we added tasks to stimulate the use of the forum and ATL, the system did not enforce participants to complete these tasks, and few participants did. Although a high drop-out rate is common in distance education, this could not explain why so few people used the peer support systems. However, there are some possible explanations. Technical issues such as password security rules and subscription keys resulted in access problems. Moreover, the design required that many measurements had to be taken: prior knowledge tests, cognitive load measures for learning activities and assessments, assessment after completing a subject. Participants were recruited from the public and not all would have been familiar with using online learning environments. Both could have made it quite complex for participants to go through the materials of the Learning Network and also use the forum and ATL system. It was striking that participants who did participate seemed eager to obtain the certificate of attendance. The certificate could be obtained when participants would complete all assessments and cognitive load measures. Those participants performed only the activities to meet the requirements. It is also possible that the peers selected by the ATL system were not the most suitable and did not feel inclined to accept the invitation as only the past workload was taken into account. As this is a relative measure of all support requests it is not discriminative enough at the start of a Learning Network when only a few requests have been made. Also the total population of peers to select from might not have been large enough.

As the above study was performed in a Learning Network for which participants were voluntary recruited, there was no intrinsic or external motivation (other than the certificate) to ensure active participation. So, the next study was designed to use existing and former Psychology students whom we asked to debate about the nurture versus nature aspect of intelligence. In one group, pairs would be formed by the researchers, in another group participants had to use a forum to find a single peer themselves. In this study we experienced many problems in recruiting students from existing courses and had to widen the recruitment to other institutions and former Psychology students. However, drop-out rate was so high that it seriously affected the results. In the paired group only a few pairs could be created, but in most pairs only one participant was active. So, effectively they were not able to perform the debate and conclude the task. In the forum group a few participants became active, but here we observed one participant who partook of all discussions and not just with the single peer. In neither

group the debate was concluded and nobody submitted the cognitive load measurement. Here the drop-out rate caused serious problems. Participants in the forum group could continue to use the forum to find a new peer when nobody would respond. Effectively, we saw that pairs were not unique and some participants participated in several pairs. In the paired group, participants got frustrated that their appointed peer did not respond, however, they had no other option to continue with the task.

## Conclusions

There seems to be sufficient evidence to support our notion of peer support and learning through knowledge sharing in Learning Networks. Support can be found in literature and is mainly based on findings in formal education where collaborative learning and peer tutoring result in benefits for learning and can lead to deeper learning provided the learning tasks are designed as such. Students in online education benefit from communication and collaborative tasks (Dawson, 2006). Our initial studies confirm the benefits of selecting suitable peers to share knowledge with, both in higher education settings as in Learning Network conditions, and provide insight in what selection criteria should be. However, our studies also showed that merely providing the opportunity to collaborate is not sufficient. The peer support system needs to provide not only a communication and interaction structure, but needs to provide the affordances that motivate learners to use these to actively engage in interactions and actively promote sustainability of interactions.

In our model, we already factored in the characteristics of well-functioning communities: i.e. accountability, boundary and heterogeneity that should act as incentives for participation. Apparently the model did not account sufficiently for incentives. A lot of research investigates motivations of participation and contribution and many theories exist to explain why people would contribute. Theories stem from sociological, psychological and behavioural domains, apply economic principles or look at game theory. A commonly referred framework is the social exchange theory, another one the prisoner's dilemma: people weigh their benefits against the investment of participation (cf (Sloep & Kester, 2009)). Others argue that it is important to visualise user and their actions (e.g. (Erickson, et al., 2002)) so they become accountable. Individual and interpersonal factors also play a role, or intrinsic (altruism, reputation) and extrinsic (rewards) motivations.

Participants of the studies involving the Learning Network on Basic internet skills registered voluntary. So, we could assume some intrinsic motivation, at least to learn about the topic, if not motivation to engage in interactions. That could also be due to the design of the material in the Learning Network. These were designed as self-study material, in the sense that no teacher was required. In the ATL and SAPS studies, participants were aware they participated in research and were invited to ask questions. This could have provided some additional incentives to use the support systems and ask questions. In the cognitive load studies we could not rely on asking questions only and added learning tasks that should have stimulated the need for knowledge sharing. However, that might have increased required study hours. In all studies, participants were informed that the material was designed for about 20 study hours. However, the total duration of the studies varied. In the cognitive load studies, a limited total duration might have put too much time pressure on the participants to allow them sufficient resources to engage in knowledge sharing or asking questions.

As pointed out above there are many factors that influence and determine what constitutes a good peer support system. In doing research one tries to isolate factors to be able to determine what factors are crucial and has to be incorporated. Investigating isolated factors can become troublesome when conditions are not completely satisfied or outside researcher's control. Furthermore our studies also showed that doing research in a truly online Learning Network situation can be challenging. On the one hand this makes it hard to do our research and experiments, on the other hand it strengthens our argument that Learning Network services have to not only provide affordances but also show to the learners the benefits of collaboration and knowledge sharing.

Our future studies need to carefully evaluate what conditions and factors are applicable; investigate possible causes for conflicting results and repeat studies and conduct follow-up experiments.

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