Using Peer-Support to Expand and Stabilize Online Learning Networks

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Sibren Fetter

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Chapter 1

Introduction

This thesis discusses the role social networks play in online professional learning. That online lifelong learning is rapidly becoming a necessity for professional development has been well established by now (Castells, 1996; European_Commission, 2000; Sloep & Jochems, 2007). It also has been established that for most online learners, learning in an online social network may be beneficial when compared to learning individually (Ma & Yuen, 2011). Yet, when it comes to theorizing on and developing of online learning environments there seems to be a tendency to think that as long as communication possibilities and content are provided, users will flock towards the social network and make it flourish (Stucky & Barab, 2007). Seen from the perspective that networks and communities need to grow bottom-up, from the users up, that is, this line of reasoning is perfectly understandable. Yet, it has its problems (Stucky & Barab, 2007).

First, online educational features such as Open Educational Resources and peer-support services directly depend on the underlying social network for them to be used at all. Take, for instance, the massive Open Educational Resources (OER) network oercommons.org (http://www.oercommons.org/). With more than 40.000 resources free for all to use as they see fit, it is a great example of what can be achieved with OER. However, it also shows how dependant its success is on user participation and interaction. The website makes extensive use of ratings, groups, tags, and social networking site functionalities. These are vital to the website as they allow users to find and judge what they need from the large pool of resources. Moreover, these functionalities provide a means of and a reason for new users to join the network. Yet the main weakness here is that the whole website relies on its users and their ability to share and communicate. In other words it relies on the social network for its recourses to be shared. So the entire sharing plan will come to naught if no social network happens to emerge.

Second, even if one were able to lure enough users into joining the network, this does not mean one can sit back and relax. The choice in methodologies, network environments, and especially communication tools will each have their specific impact on the growth of the social network over time. Take, for example, the choice of using a blog as the main communication tool in an online learning environment. In itself, the choice for using blogs is plausible. Blogs are used all over the world and have quickly grown into a very successful form of communication. Typically one person has a blog and multiple people follow that blog and comment on it if they want to. So while some readers/ commenters might have some kind of relationship between each other based on the comments, most people will mainly have a direct, one-way (one writes, the other reads) or two-way (both write) relationship with the blogger. So when the learning environment grows, it would probably grow as depicted in Figure 1: a couple of active bloggers in the center and most readers with a read-only relationship to these central

blogger(s). This is a very specific network structure, which might or might not be conducive to the network's initiators goals and purposes.

To elaborate this point further, this step – at which one wonders about the network structure that will arise due to the choice in communication tool - is paid little attention to most of the time. Although it need not, this often poses problems. Let us say that the network depicted in Figure 1.1 is an online learning environment where a couple of experts provide an insightful blog post each week. People would come to learn from these experts and the resulting network structure would be fine. But what if the goal of the online learning environment is to bring people together so they can learn from each other? What if the learning recourses and educational plans are all about user interaction? Then we suddenly have a problem as the centralized structure of the network results in nearly all communication going through the few active bloggers. In such a case, a different communication method is likely to be better. A similar argument may be made for the sustainability of a network. Typically, one not only wants a network to arise, but also wants it to last for some time to come. Again, methodologies and communication tools will affect this. In conclusion, even if networks need to grow from the bottom up, design decisions have to be made for this to happen.
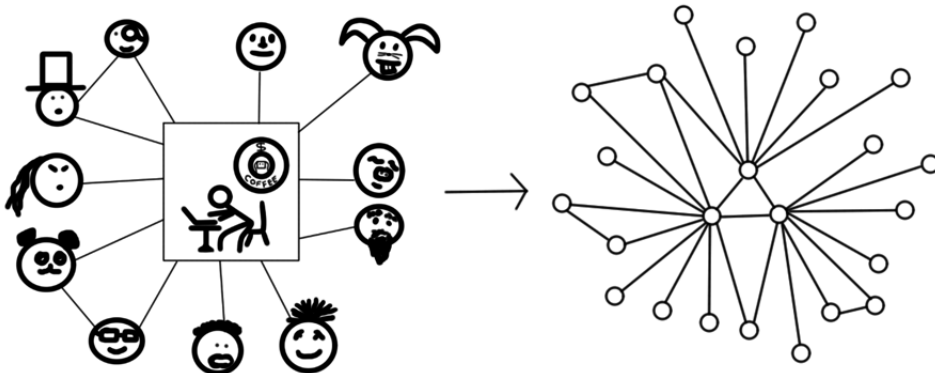
Figure 1.1 - From single blogger to blogger network

In line with this observation, my focus in this thesis is on the design aspects of social network. Content, quality of resources and suchlike I consider as of secondary importance only.

As the world of online professional learning is vast, I focus on the European teacher as my group of professionals. This firmly anchors the thesis and hopefully results in insights and lessons learned which are not directly applicable to them only but also more widely. To prepare the grounds for the rest of the thesis, I here introduce a fictitious teacher and a fictitious

network. This use case will then be followed by an overview of how this thesis tackles the question of how networks may support professionals, in particular teachers, in their work.

Viewpoint: Boris the Teacher

Boris works at a small school in a rural European village and is the only math teacher in the school. While Boris has some very friendly colleagues, he sometimes feels quite alone. The fact is, when it comes to teaching techniques, especially concerning math, his colleagues are not very helpful. They prefer old teaching methods, while Boris wants to try out new things. In his eagerness to improve his teaching techniques, as well as gain some social contacts, he starts searching the Internet for other math teachers.

Soon enough Boris finds what he is looking for. He finds a 'massive' online network that provides a platform for European teachers to collaborate and socialize. Filled with hope, Boris signs up for the network; surely he will be able to find some people here. However, as Boris logs in for the first time, he is overwhelmed by the number of possible activities in the network. There are so many things he could do that he has no idea where to start. Then he spots something familiar, namely a forum. Boris decides to look at the forum to get a feel for the network and maybe ask a short question on how to make a good start in the network. Regrettably, again he is overwhelmed by hundreds of threads collectively containing thousands of posts. Furthermore, the ongoing discussions seem to be quite in-depth and way beyond Boris' experience. Boris feels intimidated and is afraid that asking a simple question here would be seen as silly. Having to get back to preparing his lessons for the next day, he thinks he might read the help pages tomorrow in order to figure out what to do best. But, as the days go by Boris does not read the extensive help and eventually forgets about the network altogether.

Viewpoint: The Network

Since a couple of years a European teacher network has been growing rapidly. Clearly, it provides something which up to then had been lacking for European teachers. However, precisely because of the vast network growth, new problems have arisen. Communication channels are flooded and functionalities do not keep up with the large numbers of users. Also, a worrying trend has recently been identified. This trend is that the user-activity on the network actually mainly results from a relatively small group of users. Most users never participate in any activity or communication whatsoever. Furthermore, most users who participate are in contact with a few core users only. The network board has identified this as a worrisome trend because any drop-out of core users means the immediate isolation of many other users. Another risk is that most users do not feel a strong sense of being part of the community and -

being connected to each other. Finally, because users are often isolated and feel alone, the chance of them not participating in any activity is high. A lack of activity is the biggest problem for the network as engaging in joint activities is what the network is about. Without activities, the network's future is uncertain. So it is decided that, while still growing, the network needs to tackle these problems. One big constraint however is money. While the network is sponsored by the European Union, the money is needed mainly for maintenance due to the size of the network. So what the network really needs is a cheap means of bringing users together in a meaningful and active way.

Identifying the Problems

To summarize, Boris feels overwhelmed by all the users in the network and all the activities. As a novice, he does not know where to begin and how to get into contact with others. A dangerous situation, as having a high threshold for the first participation will often result in no participation (Neelen & Fetter, 2010). At the same time, the problems that Boris experiences are not unique to him. Others will experience similar problems, as these problems are inherent in the way the network is set up and run. So the people who have initiated the network and oversee its functioning have a problem too, namely, that the network does not function as intended, that is, to help professional teacher do a better job. Seen from the perspective of the collective, these problems may be described as follows. First, most registered users do not participate, are unconnected, and feel alone. Of course they have an active core group of users, but having a small core group of users can lead to an unstable situation when some drop out (DeSanctis, Fayard, Roach, & Jiang, 2003). So, the network does not only need to get its users connected more strongly, it also has to make sure that these connections are spread out over the network, make users feel connected, and finally make sure these connections are used in mutual activity.

Using sociological terminology, the above analysis may be rephrased, saying that the network needs to foster its Social Capital. The notion of Social Capital focuses on relationships people have and the possibility to use these relationships to one's advantage (Portes, 1998). It is not about the resources one possesses (financial capital), nor about the skills one has (human capital), but about the relationships one has and how these are used to gain access to other peoples' capitals. To foster Social Capital in a Network, this thesis focuses on three Social Capital pillars, namely: (a) Relationship Characteristics - *relationships need to be established*, (b) Sense of Connectedness – *Relationships need to be maintained*, and (c) Mutual Support – *Relationships need to be used*.

The research described in this thesis aims at understanding and testing the ways in which the growth of Social Capital may be fostered in an online network, specifically teacher networks. To foster the growth of Social Capital, I propose using peer-support through so-called Ad Hoc Transient Groups (AHTGs) (Sloep, 2009a). In AHTGs, 'tutors' (typically found using a matching system) and a 'tutee' work together in a small, closed-off online space to solve some issue at hand (Berlanga, Sloep, Kester, Brouns, Van Rosmalen, & Koper, 2008). Once a problem is resolved, the working space is typically available for referential purposes only, although this is a design decision that could be made differently, depending on the situation at hand. Initial research on AHTGs (or Ad Hoc Transient Communities as they are also referred to[1]) has focused on providing peer support in distance teaching settings (Van Rosmalen, 2008) and on alleviating professional tutor loads using both synchronous and asynchronous methods (De Bakker, 2010). Based on promising results from this research and also based on our own theoretical framework as discussed in Chapter 1, I hypothesize that AHTGs will foster Network's Social Capital. This is the main hypothesis of this thesis.

Sub-hypotheses are (i) that AHTGs will foster Social Capital by improving relationships between users, making them feel a member of the network, and by stimulating the users to use their relationships. In addition to this, I hypothesize (ii) that, at the same time, AHTGs provide a new and easy way for users to become active and get or stay connected. In order to answer the main hypothesis and its two underlying hypotheses, a multidisciplinary approach is chosen, combining methodologies from the social sciences, computer sciences, and the field of data mining/visualization. Below a brief overview is given of the various Chapters of the thesis and how they fit together.

Chapter 2 – Theoretical Background

Chapter 2 provides the theoretical background to my research. The concept of an online Learning Network is introduced and elaborated. It is argued that it is especially important for Learning Networks to foster Social Capital, as they rely on user-interaction for their existence. The review identifies three pillars of Social Capital, namely: Relationship Characteristics, Sense of Connectedness, and Mutual Support. For each pillar, problems reported in the literature are identified. Together with an explanation of AHTGs, the problems translate into a list of main requirements for the AHTGs peer-support service and how these would affect Social Capital. Based on these

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[1] Originally named Ad Hoc Transient Communities. For more information see Chapter 1 on why terminology was changed.

requirements, service attributes are defined, providing direct input for the design as reported in Chapter 3. Finally, an example is given on how existing Learning Networks could profit from the review findings.

Chapter 3 - Design

Based on the requirements defined in Chapter 2, the design of a stakeholder-validated, peer-support service which utilizes AHTGs is described. The design is presented using a hypothetical scenario, explaining how a user would interact with the service. An initial validation of this design was carried out with users from the eTwinning network, a network for schools in Europe (www.etwinning.net). The feedback of this validation resulted in multiple design changes. To show the broad applicability of AHTGS, the design is presented from an Open Educational Resources (OER) perspective. The reason for this is that openness of resources, as in OERs, quite well fits the philosophy of open interactions that characterizes Learning Networks. Furthermore, just like Learning Networks, the use of OER is dependent on the existence and sustainability of the communities. At the end of the Chapter it is pointed out how peer support for non-formal learning with OER can be best organized; it is also inventoried what earlier work has been done with regard to AHTGs.

Chapter 4 – The eTwinning Network

This fourth Chapter provides a more detailed insight into the eTwinning Learning Network. This insight is needed to understand the specifics of the network, as well as to appreciate why the introduction of AHTGs is especially important for the eTwinning Network. In this Chapter, data from different sources ranging from surveys to Social Network Analyses are used to give an overview of eTwinning's network state. Based on the results, two perspectives are sketched: of the user and of the network. It is generally concluded that the eTwinning network has established a strong core group that is well interconnected and supported. This core group provides eTwinning with a strong base for the future projects to build on. However, results also indicate that a large number of eTwinners are not connected at all, not to the core network nor to each other in the periphery of the network.

Chapter 5 – Testing the Influence of AHTGs on Social Capital

Chapter 5 provides an extensive overview of the first prototype of a peer-support service using AHTGs. Each step in the design process is described in detail. Special attention is paid to the matching algorithm that is used and how this determines which peers are invited. The resulting first proto-

type was tested, over the course of three months, with a select group of eTwinners. Participating eTwinners were randomly allocated to an AHTG, Forum, and Control group. The influence of the availability in the network of AHTGs was tested on all three Social Capital pillars (Relationship Characteristics, Sense of Connectedness, and Mutual Support). Results show that AHTGs seem to foster Social Capital at the level of Relationship Characteristics and Mutual Support. Results on Sense of Connectedness were inconclusive. The AHTGs do have a decentralizing effect, making the network less dependent on a few core participants. Furthermore, AHTGs have clearly been shown to have a low threshold to asking a question. In contrast, in the Forum group only a few core participants asked questions, although many participants replied. The Chapter concludes that AHTGs foster Social Capital in a different way than a forum. However, some issues remain outstanding and new issues arose. To address them, another experiment was run, as is reported in Chapter 6.

Chapter 6 – Using AHTGs in an Open Q&A, a User-Centric Experiment

Combining user feedback and the results of the experiment reported in Chapter 5, an improved, prototype was developed. In addition, the link between OERs, networked learning, and the role of AHTGs is further explored. The experiment reported in this Chapter is user oriented, in contrast with the experiment in Chapter 5, which was very much data-driven. This way, results could be examined from a different, more personal point of view. Furthermore, the user-centric approach allows for answering some of the remaining/open issues of the former experiment, with a special focus on the sense of connectedness and the comparison between fora and AHTGs. Usage-logging, surveys, online interviews and social network visualizations were used. The results obtained indicate that, also from a user-centered approach, AHTGs foster Social Capital. Interestingly and adding to what was already suggested by the Chapter 5 results, it is now shown that AHTGs and Forums are significantly different from each other: AHTGs and Forums would often benefit from each others' existence in a network, thus providing users the right tools for their specific needs.

Chapter 7 – Conclusions and Discussion

Overall conclusions are drawn on AHTGs and their influence on Social Capital in this concluding Chapter. A first conclusion is that AHTGs foster Social Capital through improving both the relationship characteristics and the mutual support. Furthermore, in combination with earlier research on AHTGs, our results show that AHTGs are ready to be used on a larger scale and adopt their place next to other peer-support methodologies. Yet, just as

all the other peer-support methodologies, AHTGs will not suit every need or every situation and need proper planning for them to work.

Finally I discuss the results and conclusions by going back to Boris and the Learning Network example. I use the insights on AHTGs and Social Capital gained, to discuss what effect the implementation of AHTGs would have had on both Boris and the network. I also provide some specific guidelines for Learning Network providers what they have to take into account. Following this, I focus on discussing our own findings in more detail. First I look back at our theoretical background plus our design and describe the lessons learned from both experiments. Second, I discuss lessons learned from my experiments and suggest future research avenues, with a special focus on using Social Network Analyses. Third, I discuss my choice for combining methodologies and approaches. Finally, I suggest multiple ways into which future AHTGs research could go.

Chapter 2

Theoretical Background and Hypotheses

Introduction

In online learning environments community formation is desirable because of its capability to enhance learning (e.g. Anderson, 2004; Brouns, Fetter, & Van Rosmalen, 2009). Communities improve learning by providing a social structure that encourages learners to participate, but also by offering goals and motivations (Greer, McCalla, Collins, Kumar, Meagher, & Vassileva, 1998). Also, a community gives participants a sense of belonging, provides easy access to other participants and, prevents the feeling of isolation participants might experience (Anderson, 2004; De Bakker, Sloep, & Jochems, 2008; Horowitz & Kamvar, 2010). Thus they reduce the chance of participants dropping out (Berlanga, Kalz, Stoyanov, Van Rosmalen, Smithies, & Braidman, & (2009). Using Language Technologies to Diagnose Learner's Conceptual Development. In I. Aedo., 2009; Brouns, Bitter-Rijpkema, Sloep, Kester, Van Rosmalen, Berlanga, & Koper, 2007; Coleman, 1988). One of these learning environments where communities are important is a Learning Network (LN) (See figure 2.1).
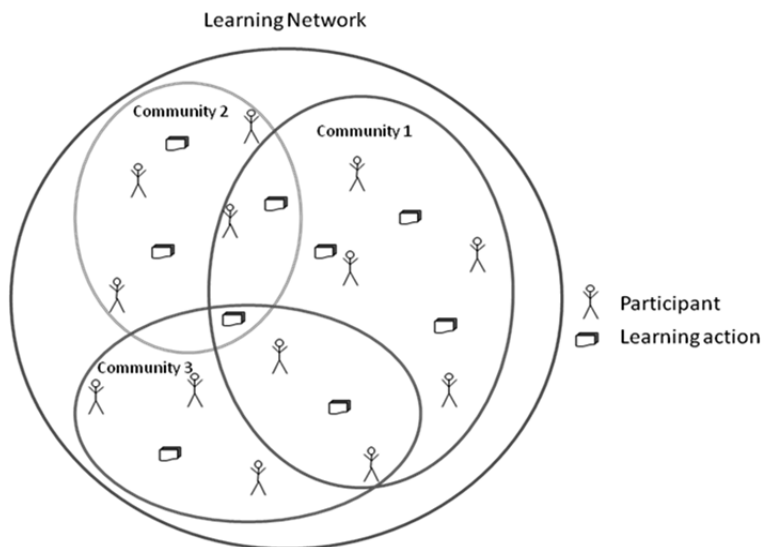
Figure 2.1 - A Learning Network.

As described by Sloep (2009b), a LN is a specific kind of online social network, one that is designed to facilitate lifelong learning and with a focus on non-formal learning (intentional learning, but without formal course). Figure 2.1 shows that a LN consists of participants (who depending on the situation can have different roles such as: learner, tutor, professional, institution, etc.) and learning actions (e.g., learning materials, courses, blogs,

etc.) all brought together through the use of computer technology (Berlanga, Sloep, Brouns, Van Rosmalen, Bitter-Rijpkema, & Koper, 2007; Long & Baecker, 1997). At the heart of each LN are the communities through which participants communicate with each other, collaborate and share information. Without communities, the LN would be an empty shell in which each learner works in isolation.

This dependency on communities brings forward an important problem for LNs, namely the unpredictability of online communities with respect to their emergence and sustainability (Chang, Cheng, Deng, & Chan, 2007; Crawley, Gilleran, Scimeca, Vuorikari, & Wastiau., 2009; Eun, Knotek, & Heining-Boynton, 2008). While communities need to be internally dynamic in order to emerge and exist (Coleman, 1988), too little or too much of it can make them unstable. Instability has adverse effects such as low information flow or a high drop-out rate (Erickson & Kellogg, 2000; Vuorikari, 2010). Therefore, it is important to increase the stability of LN communities. While many approaches are possible, we will focus on fostering *social capital.* The relationships between participants are a mayor dynamic in a social network. In turn, the social network structure is an integral part of social capital and depends on these relationships (Colardyn, 2001; Cronin, 2001). Although there are many definitions for social capital, there is a growing consensus that "*social capital stands for the ability of actors to secure benefits by virtue of membership in social networks or other social structures*" (Portes, 1998, p. 6). In other words, social capital represents not just the relationships between participants, but also the actions using these relationships through which benefits are obtained. Therefore, we argue that to foster social capital in a LN, participants first of all need to be connected, which we refer to as (1) relationship characteristics (Coleman, 1990; Eggens, Werf, & Bosker, 2008). Once participants are connected, they need to stay in the LN, which often depends on (2) participants' sense of belonging to a community (Hughey, Speer, & Peterson, 1999; Krebs & Holley, 2006; Pooley, Cohen, & Pike, 2005; Rovai, 2002). Finally, the social capital of the LN can only flourish when the participants actually use their relationships (Pooley, et al., 2005) through actions like (3) mutual support between participants (Kester, Sloep, Van Rosmalen, Brouns, Koné, & Koper, 2007).

In a LN, therefore, these three pillars should be established and maintained over time. To this end, we argue that the use of peer-support is a promising means. Through peer-support, participants help each other and it is a well documented way of working within a learning setting. Moreover, peer-support not just benefits the one receiving support, but also the ones giving support (Atkins, Brown, & Hammond, 2007; Lane, McAndrew, & Santos, 2009; Lazar & Preece, 2002). Furthermore, since providing professional support is often too expensive and time-consuming, especially in an

online setting, using peers as tutors becomes even more pressing (Coleman, 1988). In addition, because the main goal of a LN is to enhance participants' learning, peer-support can have added value for collaborative learning. Collaborative learning refers to peers learning together / from each other in groups of two or more and the benefits gained in this way. Furthermore, collaborative learning can be a stimulus for participants to learn new skills and competencies (Landauer, Foltz, & Laham, 1998).

In this paper we present the theoretical foundations of a peer-support service that aims to foster social capital in Learning Networks communities. In the rest of the paper we will first go into detail with regard to the social capital of a LN. Each pillar is explained and conclusions are drawn on what is needed to strengthen these pillars. After that, we introduce the concept of Ad-Hoc Transient Groups (AHTGs). We argue that this concept provides the benefits needed to strengthen the pillars of a LN's social capital. Then, we bring the social capital needs and AHTGs together in a list of hypotheses which will be tested in future experiments. Next, an overview of requirements and a model are given, outlining what we believe is necessary in order to acquire the desired improvements. Finally, an example on how this model will work is given and conclusions are given.

Social Capital

Social capital represents the *relationships* among participants of a social network and how these are used to gain benefits (Griffin & Griffin, 1998; Hsiao, Brouns, Kester, & Sloep, 2009; Pooley, et al., 2005). As argued earlier, to foster social capital in a LN, participants need to be connected, stay in the network by feeling a part of it, and have actions through which benefits are gained. In other words the three pillars of social capital are: the relationship characteristics (De Bakker, et al., 2008; Hsiao, et al., 2009), the sense of belonging to the community (Brouns, et al., 2007; Cross & Parker, 2004; Davis, Carr, Hey, Howard, Millard, Morris, & White, 2010; Fetter, Berlanga, & Sloep, 2012a), and the mutual support (Kester, et al., 2007).

Relationship characteristics

The relationship characteristics are an integral part of social capital (Hsiao, et al., 2009), they represent how participants are connected to each other as well as how (sub-) communities are interconnected. These relationships allow information to flow through the network and to acquire new or to strengthen existing social contacts (McCalla, Greer, Kumar, Meagher, Collins, Tkatchy, & Parkinsony, 1997). When looking at the relationship characteristics the most important are:

- The number of relationships (McCalla, et al., 1997)
- The strength of the relationships, within and in between communities (European_Commission, 2006)
- The spread of the relationships (Kavanaugh, Reese, Carroll, & Rosson, 2003)

Needless to say, without relationships no contact is achieved. Consequently, the number of relationships is important as it partly defines the general level of communication. However, many relationships *per se* does not yet mean they are used appropriately (European_Commission, 2006). The strength of these relationships therefore has to be taken into account as well. Strong relationships are those that are used frequently between participants. Strong relationships occur in small tightly-knit groups or communities where participants extensively collaborate and socialize. Additionally, Granovetter (1973) argued that not just strong, but also weak relationships have an important role in social networks. As described above, strong relationships mainly occur in small communities or groups, yet weak relationships especially characterize the contact throughout the social network. These weak relationships are often referred to as bridging relationships. These relationships have the important function to keep participants and communities in contact with other with participants which are not part of the smaller inner groups (European_Commission, 2006; Hsiao, et al., 2009). This allows for fresh ideas to "invade" the smaller community, as well as provide participants with better chances of finding other participants in case of need (Hsiao, et al., 2009).

However, knowing the strength of individual relationships still does not say anything about their overall characteristics. One should know how all these connections are spread out over the network in order to reveal any bottlenecks. When a small core group of participants is very active, it can make the community prone to becoming unstable (European_Commission, 2009; Meyerson, Weick, & Kramer, 1996). Because most communication and activity goes through the core participants, the loss of one or more of them could easily disrupt the communication and, as a consequence, information-flow throughout the whole community. Also, participants can become isolated if they are only connected to a core person only, rather than to others as well. A community which depends on a small group of core participants is said to be highly centralized (Kavanaugh, et al., 2003). Figure 2.2a and Figure 2.2b exemplify this. They represent two communities; the first has a high centralization, the second has a low centralization. As can be seen with the first community, most relationships depend solely on a small core group. If one of the core group participants would disappear, a significant number of participants (and groups) is likely to become isolated.
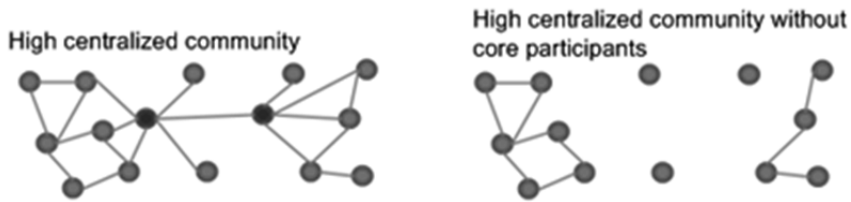
Figure 2.2a – high network centralization. Before and after drop-out of central participants.
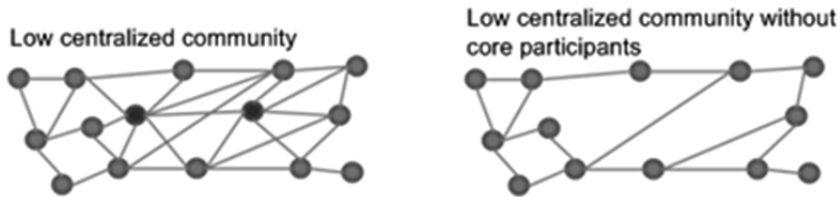
Figure 2.2b – low network centralization. Before and after drop-out of central participants.

High centralization brings another problem in its wake. In a highly centralized network core participants are the contact persons for most other participants. This will easily lead to the core participants being flooded with requests. This is problematic because it has been shown that participants are more likely to stop participating if they become overloaded with information (Vuorikari, 2010).

In conclusion, for social relationships to have a positive influence on the LN's social capital: (1) there should be many relationships between participants, (2) these should consist of weak and strong links, which (3) should be spread out in a decentralized way.

Sense of belonging to the community

A sense of belonging or sense of community is another important part of the social capital (Fetter, et al., 2012a). Participants need to feel part of the community, feel they have peers they can rely upon (Gyongyi, Koutrika, Pedersen, & Garcia-Molina, 2007) and are able to collaborate with or ask for support (Brouns, et al., 2007; Davis, et al., 2010). A low sense of belonging can lead to feelings of detachment, isolation, distraction, and lack of personal attention, heightening the chance of participant drop-out (Berlanga, et al., 2009; Brouns, et al., 2007; Coleman, 1988). Drop-out is an important problem of online learning communities, as drop-out is often 10 to 20 percent higher than it is for learning communities in which participants meet face to face (Brouns, et al., 2007; Cho, Gay, Davidson, & Ingraffea, 2007; Huang, Brink, & Groot, 2008).

Improving a sense of belonging is not only positive for reducing drop-out. It has also been shown to increase the students' involvement in community activities as well as encouraging them to make more contacts (Brouns, et al., 2007; Fiedler & Pata, 2007). For example, a study done by Dawson (2006) shows there is a significant relationship between frequency of communication and sense of belonging. Furthermore, the results support the notion that an increase in communication and sense of belonging improved the community experience of the learners.

Additionally, it has been shown that the existence of a community and a strong sense of belonging can improve participant's retention. Feeling part of a community can be a powerful incentive for learners to stick to their learning goals and see them through, rather than giving up (Brouns, et al., 2007).

We argue that in a LN social capital can be improved by heightening the participants' sense of belonging to the community. Not only through a direct improvement by making them feel part of the community, but also through the indirect effect the sense of belonging to the community should have on reducing drop-out, and the higher incentive for participants to stick to their goals and stay active within the community.

Mutual support

This aspect of social capital is about actions that foster knowledge sharing within a community. According to Lesser, Fontaine, and Slusher (2000) these actions positively influence social capital in *three ways*. First, mutual support becomes an informal type of currency. It allows participants to value each others' performance and willingness to help. Second, combined efforts result in a more positive view on the community as a whole, especially when subjects are closely linked. And finally, to retain social capital, it needs to be maintained, by re-establishing, sustaining, and creating relationships between participants (Griffin & Griffin, 1998; Gyongyi, et al., 2007).

Ad-Hoc Transient Groups

In Ad-Hoc Transient Groups (AHTGs) participants work together in a private surrounding to the ad-hoc request after which the group dissipates. In short, participants that have a learning-related request are helped by other participants in a private space ('ad-hoc') and for only a limited amount of time ('transience') (Berlanga, et al., 2008; European_Schoolnet, 2010). This concept was first introduced as Ad-Hoc Transient Communities (AHTCs), but we have chosen to use the term Ad-Hoc Transient Groups (AHTGs) in-

stead of using the term "community". Our main reasons for this change are the transient and closed aspects of the AHTGs. As summarized by Boomen (2008), a community consists of participants who have ongoing interaction in a shared virtual space. Since AHTGs exist only for a limited time and are only privately accessible, the term "community" is misleading in a way in which the term "group" is not.. The term "group" was chosen following McGrath, Arrow, and Berdahl (2000) who view groups as '*bounded, structured entities that emerge from the purposive, interdependent actions of individuals*'.

It is our goal to deepen the concept of AHTGs so it includes the effects on social capital of a LN. This deepening of the concept is in line with the wish Poole, Hollingshead, McGrath, Moreland, and Rohrbaugh (2004) bring forward that more interdisciplinary approaches are needed in the field of small-group research. Our starting point is the initial research done by Van Rosmalen, Brouns, Sloep, Kester, De Jong, Berlanga, Bitter, and Koper (2007) which provides evidence that AHTGs (or AHTCs as they refer to) are appreciated by the participants. In their experiment, participants posted a question, after which two other participants were matched and invited to answer the question. Together the participants worked in a private wiki to answer the question, which was disbanded once the answer had been given. The experiment showed a positive effect on learning if peers were selected at random for the AHTG (Control group). However, it proved even better to use the matching mechanism (experimental group). Using this mechanism significantly increased the responsiveness, quality of the answers, and perceived usefulness (Drachsler, Hummel, & Koper, 2009). Based on these initial findings and service design characteristics, we believe the AHTG concept can be extended to the influence on the relationship characteristics and the sense of belonging to the community. In this paper we provide a priori arguments to support the idea that AHTGs do not only improve social capital through better mutual support between participants, but also have a positive influence on the relationship characteristics and the participants' sense of belonging to the community.

As described earlier, it is our main hypothesis that the use of AHTGs will improve social capital. Empirical tests therefore are needed to reveal what influence AHTGs have in a more general sense on the social network structure and on the sense of belonging. In upcoming studies we intend to investigate to what extent AHTGs may function as a lever to decentralize the social network, and increase the sense of belonging (European_ Commission, 2009). By creating many fleeting moments of contact, an increase and larger spread of ties between learners is expected. This would decrease the centralization and improve the communities' social capital.

Furthermore, we expect that by introducing AHTGs the sense of belonging will go up because participants will gain more contacts and feel less

isolated as well as perceive the community as more effective because their needs are met. Finally, we also believe that the use of AHTGs will improve the mutual support. Because AHTGs should be easy to use the threshold to do so should be low. This again should lead to more requests being made and the participants considering the community to be of higher value.

Requirements

In order to test the desired effects as stated in the above hypotheses, a LN has to meet several requirements for the tests to be adequate. What follows is an overview of these requirements according to the pillars of social capital mentioned earlier.

Improved relationship characteristics

To test whether the relationship characteristics improve through decentralizing the community and increasing the relationships between participants, participants with a request should not have to find suitable peers by themselves. If they would have to the workload of the participant would increase extensively, because trying to find the right participant to fulfil a request by oneself might be very difficult. For example, participants might not be aware of the knowledge/competences others have, they do not know all participants in the LN, they will not be so keen on contacting people they do not know, or they might not have the time. Therefore participants need support to find out whom to contact for their request. Because each request is different, so will each advice on which participants should be able to answer the question, and help the participant. In the long run, this means that the number of relationships and their spread will increase, decentralizing the community.

Higher sense of belonging to the community

To test whether the sense of belonging to the community can be heightened, participants should be able to make contacts, handle requests, and have a high chance on meeting again. For this to work, it important that participants are recognizable to each other, as well as have a system for handling requests that is fast and brings participants together. In addition, an increase in *perceived* community effectiveness is required as it has been shown that an increase in community effectiveness can have a positive influence on the sense of belonging to the community as well (Brouns, et al., 2007). We surmise that to improve the perceived effectiveness, it is important for participants to see what others are doing. To this end, requests

made and fulfilled successfully should be publicly accessible (with consent) and there should be enough possibilities for participants to communicate with each other once the AHTG has dissolved.

Better mutual support

To test increases in mutual support, it is vital that an environment is created in which it pays off to help others. This means that the right cooperation strategy is required. Although many sophisticated strategies have been elaborated, we will, as a first approximation, start off with a tit-for-tat strategy, as described by Axelrod (2006). This collaborative strategy holds that one starts to collaborate as a first move and after that always copies the other person's moves. So collaborating is reciprocated with collaborating and defecting with defecting. This strategy has been shown to be effective under a variety of circumstances (Fetter, Berlanga, & Sloep, 2009). There are three conditions which are needed for the tit-for-tat strategy. (1) The groups in which participants work together are small, (2) The chance for participants to meet again over time are high, and (3) participants are accountable for their actions. These requirements should be considered when defining peer-support services that support AHTG. Figure 2.3 shows how the social capital pillars, requirements, and services attributes are linked together.
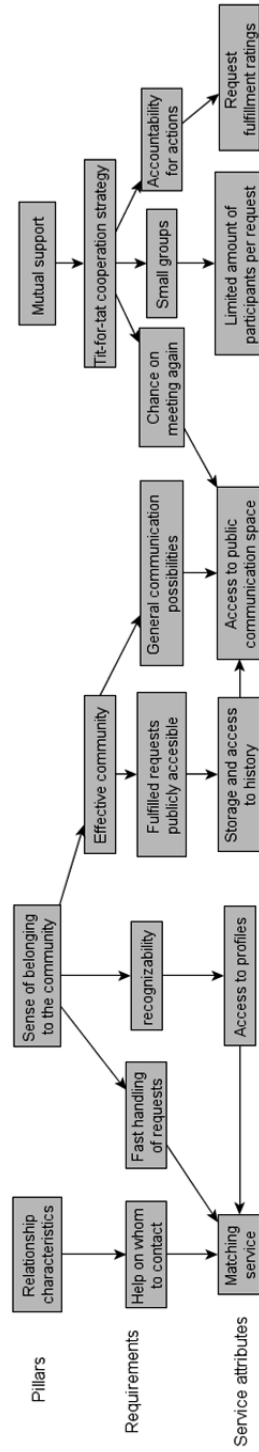
Figure 2.3 – Social capital pillars, requirements, and service attributes

Ad-Hoc Transient Groups' service attributes

As argued earlier, it is important for participants to receive advice on whom to contact. To this end, AHTGs will use a peer-matching mechanism. A list of most suitable peers is constructed for each request submitted by a participant. The scores upon which the ranking of most suitable peers is based depends on the data available in the network. For example, an international LN might have a strong need for language matching, whereas the same matching can be without meaning for a LN in which all participants speak the same language. Together the chosen matching scores provide a ranking of the most suitable participants. Following this ranking, participants are personally invited to fulfil the request, and in the case of a rejection the next participant is invited and so on. This loop should also create a fast handling of the request.

For participants to be recognizable, the service will make use of participant profiles. However, because we see AHTGs as being part of a larger online social network (indeed, a LN), it would be preferable if already existing profiles within the LN are used. The same holds for the access to the public history and communication space. The AHTG service has to have access to a database service for the history, as well as a general communication method, both used in the LN.

The use of a general communication method together with the AHTGs should lead to a high chance for participants to meet more than once. This combined with a limited number of invited participants per request and request fulfilment ratings should set the stage for a tit-for-tat cooperation strategy to arise. The limited number of participants evidently keeps the groups small and prevents free-riding and spread of responsibility. At the same time the rating of the request fulfilment is expected to have an influence on the accountability of the participants. Clearly these ratings are taken up in participants' profiles and are publicly accessible.

The eTwinning network: an Example

In order to exemplify how the theoretical foundations of a peer-support service based on the AHTG concept will solve a practical problem, we will briefly describe an existing LN and how the AHTG service will help to foster the social capital of this particular network. The eTwinning network is a network for schools in Europe. Its aim is to provide teachers a platform where they can carry out projects together and learn from each other (Crawley, et al., 2009). However, at the moment there are many teachers in the network who are not connected to anyone. There are two more issues with the network. Teachers are not able to find the right partner and it is hard to organize collaborative work (Crawley, et al., 2009). AHTGs can help solve these

problems by providing an easy way for teachers to ask questions and thus be brought together. Especially, in large networks like these the matching becomes vital, since manually searching over 70.000 profiles is unmanageable. Using a AHTG peer-support service, teachers can post questions. Once posted, they receive a list of best matches and can include / exclude people themselves, and indicate whether they want the system to match them to others. Once appropriate teachers are invited to an AHTG (and have accepted), they work together in a private space where messages can be posted. Once the teacher who asked the question feels the question has been answered satisfactory (or not), she or he closes the question. In closing the question, the questioner indicates whether the answer was satisfactory, and can send the helping teachers a personal message. For a more in-depth use-case, see Fetter, Berlanga, and Sloep (2010b).

Conclusions

We believe that using an AHTG peer-support service as outlined above will improve the social capital of the LN. This is done by improving the relationship characteristics, heightening the sense of belonging to the community and intensifying the mutual support between participants. In this paper we presented the theoretical framework and considerations to define an AHTG peer-support service. First steps in this direction have already been made, as reported in Fetter, et al. (2010b). Using this design, the model will be tested using simulations. These theoretical foundations and upcoming simulations provide the basis for our future experiments that will take place in the European eTwinning network (Koper & Tattersall, 2004).

Chapter 3

Design

Introduction

Before Open Educational Resources (OER) can be used, they first need to be created and stored in an open repository (Atkins, et al., 2007). From this repository others can then retrieve a variety of resources, use them, possibly change them and then potentially share these changes again with another group. So, for example, a teacher may wish to construct a list of common English grammar mistakes. The list created can be uploaded to an open repository and thus becomes accessible to others and can be added to over time. It is argued that worldwide, such learning and teaching resources are revised on a daily basis. Yet most of the time, these resources remain with their creator(s) (Caswell, Henson, Jensen, & Wiley, 2008). It is easy to see how massive gains could be achieved if such resources were open and shared. For example, teachers could choose to use such resources in their entirety in their lectures and classes, or they could integrate bits and pieces of a number of resources into material they themselves have developed over the years. Alternatively, they may allow themselves to be inspired by the resources that others have created. A great deal of the literature produced over the last decade on the topic of learning objects take a similar kind of a stance. It deals with sharing, arranging and editing content, with the only difference seeming to be that it does not necessarily assume that the resources are open (Littlejohn, 2003; McGreal, 2004; Sloep, 2004). Yet creating and sharing OER is not without its costs. Downes (2007) does point out that the mutual benefits can easily outweigh the individual costs. For example, Lane (2008) summarizes some of the advantages of using OER for teachers: (a) learning best practices from one another, (b) allowing a larger volume of students to study simultaneously, (c) accessing groups of learners yet unknown or out of reach, (d) providing wide recognition of the services offered, and (e) offering a global reach. The focus in this Chapter is on teachers and their use of OER. The main reason for this approach is that OER often starts with the teacher creating a learning resource. In practice, however, using OER can mean that these teachers will have very different roles ranging from student to lecturer. The role actually assumed depends on the specific OER and the context in which they are used or accessed (Lee, 2008).

One issue which arises, however, is that merely having resources open for use and recognising their possible advantages do not automatically imply that they will actually be reused or shared. For OER to develop and become more widely adopted, it is argued that an underlying community is needed (Atkins, et al., 2007). Sharing and collaborating therefore emerge as key aspects of any OER, making a community approach a necessity (Downes, 2007). Yet facilitating such communities continues to be a challenging issue for the OER movement (Margaryan & Littlejohn, 2007; Sclater,

2009). A good example of such a community of practice in action can be seen in the Merlot repository, the underlying design of which was built according to a peer-review system intended to improve the resources' quality. Whilst this is an admirable goal, the reality is that fewer than 14% of the Merlot resources are peer-reviewed (Downes, 2007). The difficulty of such community formation is not limited to the use of OER, as it is also a well know issue in the field of online learning in general (Fetter, et al., 2010a).

The need for having an actual, active community becomes especially important when OER are situated in a non-formal context. Examples of such environments might be where the new learning context does not necessarily involve school classrooms, lecture halls, fixed curricula or scheduled timetables. Rather, imagine a non-formal context in which people are trying to acquire particular competences to nurture a particular interest they may have without any of the previously mentioned components. The learner's interest may be work-related or hobby-related or may have to do with other personal interests. These learners may be supported by their employer or may be studying independently. Taken together, non-formal learning is learning in a directed and conscious way, outside of formal education (Colardyn, 2001). Indeed, the European Commission has indicated that Europe should embrace more lifelong learning policies lest it lose its economic privileges (European_Commission, 2000, 2006, 2009). In this context, lifelong learning encompasses both the initial phases of learning, which tend to be experienced in the formal contexts of schools and universities, and the post-initial phases for which non-formal contexts are better suited (Fetter, Berlanga, & Sloep, 2008; Van Merriënboer, Kirschner, Paas, Sloep, & Caniëls, 2009); see also Billett (2010).

For example, a high school teacher called Julia, who typically teaches in a formal surrounding, may have the need to learn new teaching techniques. In her free time she visits all kinds of websites to learn new pedagogical techniques. These types of learning situations have become increasingly important with the advent of the knowledge economy and the increasing complexity of our society (many references, but see Sloep & Jochems (2007)). Yet as this kind of learning becomes more important, facilitating a community in a non-formal context can become more challenging precisely because it lacks the ready-made context that formal learning situations offer (Fetter, et al., 2010a). Take Julia, with her need to learn new teaching techniques. She could take a formal, weekly course on teaching techniques. Meeting every week with the other participants in the course can quickly lead to a small community of practice. However, it is conceivable that for some reason (e.g., time, money, and/or place constraints) she is not able to enrol in such a formal course. So, new techniques must be learnt through various websites as described above. While these websites might allow her to communicate and collaborate with others, this is by no means a given.

Furthermore, even when there are good possibilities for communication, one remains invisible until one actually actively communicates with others in the community (Neelen & Fetter, 2010).

In short, OER need communities to function properly. This need becomes even more pressing when the OER and their users are mainly situated in a non-formal learning context (Sloep, 2009a). Yet a community will not necessarily form around a large repository of OER. While it is clear that community formation is a challenge which includes many types of learning situations, in this Chapter the focus is on how to stimulate community formation in a non-formal learning context. Furthermore, the specific aim is to support the teachers using OER, as they are their main creators and users. It is especially this combination of OER in a non-formal context that makes the creation and sustainability of community vital for the OER to be used and shared.

Peer support has been proposed as a promising means for stimulating community growth and promoting its sustainability (Fetter, et al., 2008, 2009, 2010a; Van der Baaren, Schuwer, Kirschner, & Hendriks, 2008). Through peer support, participants are able to help each other; the success of peer support has been well-documented as a way of working together in learning settings. Moreover, peer support not only benefits the receiver of the support, it also profits the giver (Hsiao, et al., 2009; Roscoe & Chi, 2007; Wong, Chan, Chou, Heh, & Tung, 2003). Furthermore, since providing professional support is often too expensive and time-consuming, especially in an online non-formal setting, the need to have one's peers serve as tutors becomes even more pressing (Kester, Van Rosmalen, Sloep, Brouns, Brouwers, & Koper, 2006). In addition, peer support can have added value for collaborative learning. Collaborative learning refers to peers learning together or from one another in groups of two or more and to the benefits gained in this way. Finally, collaborative learning can be a stimulus for participants to learn new skills and competencies (Smith & MacGregor, 1992).

In spite of all these potential benefits, mechanisms must be in place which actually connect up people, preferably while requiring little effort on their part. Therefore, in the next section the notion of Ad-Hoc Transient Groups will be discussed, as these are believed to provide such a mechanism (Fetter, et al., 2010a). Then their use in the context of peer support for Open Educational Resources will be explored. In doing so, first design considerations will be addressed, followed by an initial validation of this design. Finally, there will be a general discussion of the findings, conclusions, and future research

Ad-Hoc Transient Groups

As argued, peer support plays a crucial role in non-formal learning environments. This is not only because learning benefits from the social interaction (Brown, Collins, & Duguid, 1989; Brown & Duguid, 2000; Ma & Yuen, 2011), but also because intensifying and expanding one's social network is part and parcel of building a professional network. In other words, what may start as a learning community in a large, loosely organised network, may well become a close-knit community of practice. But how do these social interactions come about? After all, in a large network, people who are interesting to interact with may indeed be available, but how does one locate them? To solve this problem, the concept of Ad-Hoc Transient Groups (AHTGs) was developed - small groups of people who are assembled to a purpose. AHTGs are developed with the aim of solving a particular issue and may be disbanded once the issue has been resolved. Through AHTGs people get to know each other and, should they want to, also expand their personal networks. By creating many short-term moments of contact between the participants of a network, one can expect an increase in the number of ties between the participants and a broadening of their scope to follow. It is furthermore expected that introducing AHTGs into networks will increase the participants' sense of belonging, as they will have more contacts and will perceive the network as more effective as members help each other to meet their needs (Sloep, 2009b).

Put differently, it is argued that a peer support service based on the concept of AHTGs is a promising means for fostering Social Capital (Fetter, et al., 2010a). Social Capital represents how well peers are connected in a network and use their connections to gain knowledge from their peers (Portes, 1998). Fostering these aspects of Social Capital has been shown to increase the probability that the community will form up and/or stay in existence (Coleman, 1990; Kester, et al., 2007 ; Rovai, 2002). For this participants need to become connected, which may be called (1) the establishment of relationship characteristics (Coleman, 1990; Eggens, et al., 2008). Once participants have been connected up with one another, they need to maintain the connection, which often depends on (2) the participants' sense of belonging to a community (Hughey, et al., 1999; Krebs & Holley, 2006; Pooley, et al., 2005). Finally, the Social Capital of a community can only flourish when the participants actually use their relationships (Portes, 1998) through actions such as (3) providing mutual support among participants (Kester, et al., 2007). For the underlying theories please refer to Fetter et al. (2010a).

The behaviour of AHTGs is characterised by (a) the self-organising powers of the community and the absence of hierarchies, (b) the negotiation processes that the members engage in, (c) the expectation members have of

the actions and behaviour of their fellow members, (d) the work of members towards a set of goals through united actions, and (e) the emergence of relationships of trust between the members (Rusman, Van Bruggen, Sloep, & Valcke, 2010; Sloep, 2009a). In addition, research done by Van Rosmalen (2008b) has shown that AHTGs are more effective when they employ a matching system to find suitable peers. Research on matching people, or people recommendations, is not new. Terveen & McDonald (2005) define Social Matching Systems as systems whose aim it is to assemble people with similar interests. A social matching model should include (a) a *user profile,* which contains information on individuals that the system needs in order to identify their capabilities; (b) a *matching mechanism*, which identifies the profiles which go best together; (c) an *introduction,* which offers people various ways of learning about potential matches, introducing themselves and interacting with others; (d) *interaction*, which provides communication tools to help encourage interaction, preserving users' privacy until they decide to reveal their identities; and (e) feedback, which allows users to update their profile so they can receive even better recommendations. Much work has been done on social matching systems for workplace contexts, most of it related to finding experts (Crowder, Hughes, & Hall, 2003; Ehrlich, Lin, & Griffiths-Fisher, 2007; Lin, Ehrlich, Griffiths-Fisher, & Desforges, 2008), but also a few that are related to peer support (Greer, et al., 1998; McCalla, et al., 1997). In learning contexts, some work has been done on social matching systems for peer support, particularly in the context of communication spaces such as discussion forums (Wei & Chen, 2006) or chats (Ribak, Jacovi, & Soroka, 2002; Vassileva, McCalla, & Greer, 2003).

In a larger context, the ultimate aim of AHTGs is twofold. Firstly, they are meant to support voluntary, emergent, informal knowledge sharing (Berlanga, et al., 2008); and secondly, they should stimulate community growth in an online learning environment (Fetter, et al., 2010a). These two goals go beyond the use of AHTGs in relation to OER. A future possibility would be, for instance, to integrate an AHTGs plug-in into a social network such as Facebook. It is easy to see how AHTGs could use the vast quantities of data available to find people who would fit a particular individual's needs. A variety of knowledge sharing processes may be discerned, depending on what the members of the ad-hoc group seek to achieve together. One example is peer tutoring on content-related questions in open learning courses (De Bakker, et al., 2008; Van Rosmalen, et al., 2008b). With respect to the present context, peer support would include peer advice on how to work with and deploy OER, peer review and assessment of OER, and peer collaboration to create or gather OER or to produce metadata for it. That said, in this context as well, our approach offers excellent opportunities which can be deployed successfully. As Davis et al. (2010) state, having

teachers use OER does not depend so much on providing a large repository of OER (as was thought until fairly recently), but rather it depends more on providing opportunities to teachers for sharing and organizing their OER and being part of a community (Margaryan & Littlejohn, 2007). The way in which OER are used and their specific types are not that important; this depends mainly on the teachers in the community. This paper therefore starts from a community perspective, whereas until now most OER approaches started by providing and defining resources (Davis, et al., 2010). In this light no specific types of OER will be defined, as it is believed these should be defined by the community.

In the next section, the AHTG approach will be explored by examining a specific peer advice scenario. In this scenario, a design initially constructed for a peer-support service which uses AHTGs is used. This design is based on previously determined design considerations (Fetter, et al., 2010a), namely:

- being able to find the right participants with a matching system;
- making participants accountable for their actions through ratings;
- showing participants' previous activity and contacts to increase the sense of belonging, enquiring the service to be accessible and user-friendly.

Peer Support Service Design

A Hypothetical Scenario

Julia, an exemplary secondary school teacher, has always had an interest in gender issues. She notices that, in spite of all her efforts, her students continue to have difficulty discussing such issues rationally in the classroom. She is a member of the eTwinning network (see the next section) and has access to its associated repository of resources. She does some research and discovers that there are several resources on gender topics available. She selects one and starts to read it. Soon she realises that she has no idea on how to deal with the resources or how to use them to help her solve the problem. However, there does appear to be a tutor or teacher whom she can ask questions.

This tutor, it turns out, is a piece of software – a so-called peer support service – that brings her in contact with fellow repository users (peers). The service creates for her small groups of peers with similar interests and problems (an Ad-Hoc Transient Group, as discussed). To use the service, she needs to fill in a profile, which the service needs in order to do the matching. So she decides to register and fill in her profile. This includes a description of the subject(s) she is knowledgeable about, a description of

the subject(s) she takes an interest in (in this case, gender issues would feature large on that list), and a list of her language preferences. Once registered, Julia enters her problem in a form (see Figure 3.1) and indicates some of the characteristics of the question at hand (e.g., the subject and language of the question).

Figure 3.1 - Ask a question

After having done all of this, the service's matching system generates a list of people who it thinks would be able to help her, including the matching scores that represent their suitability (see Figure 3.2). To find the most suitable participants for Julia, the matching system takes into account all the information in Julia's profile, the subject and language of her question, and the profiles of others. The service then calculates sub-scores, which are accumulated into a single matching score. Sub-scores are provided based on the following categories (Fetter, et al., 2010b):

Availability: The number of requests accepted by a particular participant relative to the number of requests accepted by all participants. Thus, the more requests a participant has accepted, the lower his or her availability score is.

Content competency: Participants whose expertise subject(s) is/are similar to the question category receive a positive sub-score.

Similarity: A correlation score is calculated based on the participants' subject(s). The higher the correlation, the more similar they are.

Language: Based on the language of the question, only those participants who have the same language selected in their profile are considered in the matching exercise.

Invite people from the list below:

Include	Exclude	People	Suitability
☐	☐	Name: Test4 Test Gebruiker4 Answers:0	0.5
☐	☐	Name: Test3 Test Gebruiker3 Answers:0	0.42
☐	☐	Name: Test6 Test Gebruiker6 Answers:0	0.33
☐	☐	Name: Test5 Test Gebruiker5 Answers:0	0.25
☐	☐	Name: Test2 Test Gebruiker2 Answers:0	0.17

⏮ ⏪ ◀ ▶ ⏩ ⏭

5 people found, displaying 5, from 1..5, Page 1/1.

| Invite Selected People | Choose for Me | Help |

Figure 3.2 – Finding People

Once the overall matching score has been calculated, the service then creates a list with the top ten best matches for Julia. She can then choose from this list and invite others to help her, or she can let the service do this for her. She decides to let the service invite people for her. The service then sends email invitations to the first few people who appear on the list. The invitation includes Julia's description of the problem and a request to join a shared workspace. If the people invited do not reply within a set period of time (say, one to a few days), or if they happen to decline the invitation, then the service sends out invitations to the next few people on the list. The process stops either when a sufficient number of people accept or the list has been depleted and insufficient numbers of peers have indicated their willingness to help. In the latter case, the service informs Julia that no peers were available to help her.

Luckily, two people did accept the invitation, and as a consequence they have been given access to the temporary, group-specific workspace.

These two people together with Julia thus form an AHTG. In the workspace, they discuss the question that Julia posted and interact with each other to clarify it. Depending on the configuration, the group space could be a forum, a wiki or a chat; basically, anything will do that allows collaborative editing and keeps a historical track of the interactions, in case participants want to retrace their steps.

Julia and the other two people will have access to this space through the "My Questions and Answers" screen as portrayed in Figure 3.3. This is the main screen of the service. It gives access to:

- the currently active question with its associated group space;
- a list of recent activities (questions asked and answered);
- the list of current collaborators;
- a box through which one can ask new questions (Figure 3.3);
- general preferences for the service.
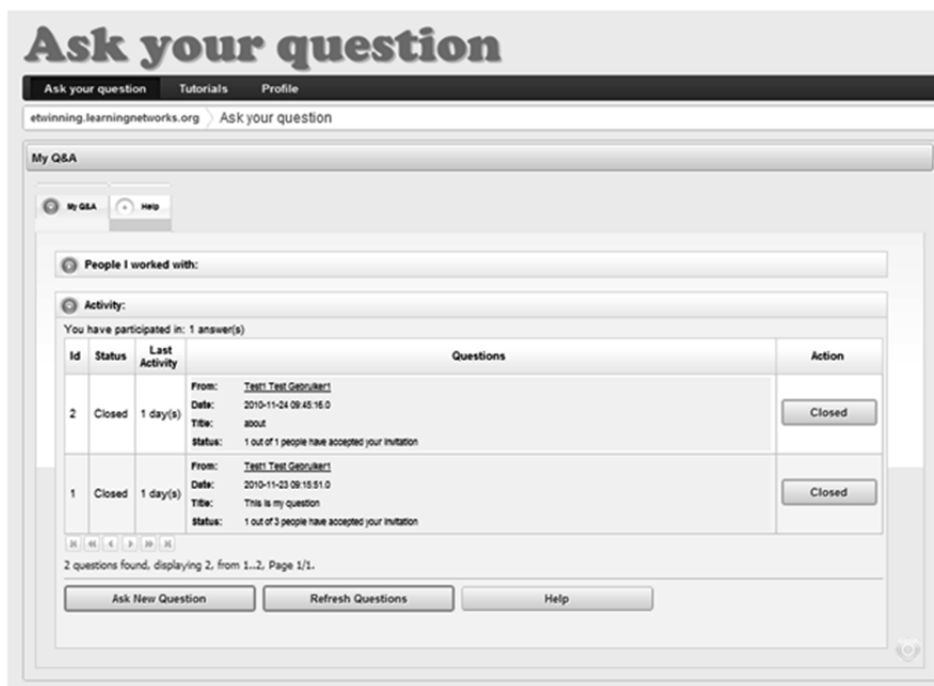
Figure 3.3 – My Questions and Answers

Julia starts to discuss her question with her peers in the group space, and once her question has been discussed to her satisfaction, she flags it as closed. Upon doing so, she is asked to rate her peer helpers as well as indicate the degree to which she is satisfied with the answer arrived at (see Figure 3.4). Afterwards, the service includes the people who have participated

in the AHTG in the list of "people I worked with", so that Julia will be able to contact them if she wants to.

Figure 3.4 – Ratings

Feeling strengthened by the answers she has received, Julia decides to set up an eTwinning project about gender issues. Julia contacts some of the eTwinners who helped her, and together they set up a proposal for the project. In this project they plan to use the existing resources on gender issues, but extend them with cultural influences. Their project is accepted and is a great success. Their students learn a great deal from meeting and discussing gender issues with other students from different countries. As eTwinning recognizes the success of the project, the organizers are then asked whether it can be used as a template. Their project thus ultimately becomes one of the project templates available in eTwinning, available for all to use again in the future.

Initial Validation of the AHTG Service

The design just described has been captured by software and validated following a user-centred design approach as described by Parmar (2009). It operates on the assumption that ICT tools such as the present one should

be developed together with stakeholders in order to arrive at a user-defined service that fulfils the stakeholders' actual needs. As the plan is actually to deploy this service in the eTwinning network, a validation workshop was held as part of the eTwinning Conference 2010 (for more information see the description below).

The eTwinning (the www.eTwinning.net) network was launched in 2005 by European Commission. ETwinning is a network for schools in Europe and its purpose is to virtually assemble educational staff and their students from all over Europe. The network allows teachers and students to collaborate on projects which can range from discussing the educational use of a resource or improving math teachers' teaching skills to having multiple secondary school students work together and learning about different cultures. An eTwinning Network conference is held annually to encourage people to meet and do business face-to-face.

Twenty-two people participated in the validation workshop, 20 of whom were teachers. After a word of welcome, participants were asked to fill in an initial questionnaire, the purpose of which was for us to get a feel for the eTwinning network. The questions asked addressed such issues as when they had joined the eTwinning Network and how they would get in touch with fellow networkers, if indeed they did so. Once the initial questions were filled in, a brief introduction to Q&A (Question and Answer) websites was given. Then groups of five or six people each were formed, to whom an initial design for the peer support service was presented. Each group was then individually taken through the design in a step-by-step fashion. Each step was accompanied by mock-up screenshots of the service (as illustrated in the previous section); also, a handout with some suggestions for issues they might want to address was provided. Participants were encouraged to give feedback at any moment, either verbally or on paper. At the end of the workshop, the participants' findings and opinions were discussed in relation to the aims of the service.

The feedback provided by participants addressed a variety of different topics, such as layout changes and layout-related pitfalls; various functional features were also discussed, such as being able to exclude people from the invitations, being able to invite those one has already worked with, and, significantly, their lack of willingness to rate others. The initial design required users to rate the peers who had accepted the invitation to work collaboratively on an answer in the context of an AHTG. Interestingly, the participants in the workshop were adamant about not wanting to rate their peers. Together with the participants in the workshop a rating was conceived that everyone in the workshop found satisfactory: a participant's rating would consist of the number of satisfactory answers he or she had given. An opportunity to provide feedback (i.e., a text box for each partici-

pant once the question is closed) was also something the participants wanted. This would allow them personally to thank those who had helped them.

Related work

As we have already argued in the introduction, there seems to be a genuine need for an approach as described here in the context of OER. By themselves, OER may not be sufficient to provide most people with meaningful learning experiences (Lane, et al., 2009). This, of course, is particularly the case in non-formal contexts such as Julia's learning context. This need is also evidenced by the increasing number of new initiatives that combine open content with learning environments that offer tools for communication, such as OpenLearn (openlearn.open.ac.uk) or Peer 2 Peer University (p2pu.org). These initiatives underscore the importance of peer support in an OER environment. Both initiatives are good examples of OER networks that are focused on the user rather than on the actual resources provided. They provide the possibility to follow online university courses free of charge. In addition, both provide users a large range of possibilities for contacting their peers, ranging from a forum to special learning clubs. Moreover, both also allow users to add their own courses or collaborate with others to improve existing ones.

Yet, with so many possibilities involved, the energy that any user may need to invest to find a matching peer by himself or herself quickly becomes prohibitive, more rapidly so as network sizes increase. This is evident in the case of such huge networks as the eTwinning Network, which has over 80,000 participants. One can easily see that such a network, if unaided by the kind of matching tools discussed, cannot function effectively and efficiently. At the moment, it depends on a relatively small core group of users who are active, with many isolated users who have no contact with the others. As a consequence, many users do not benefit from being part of the eTwinning network, which hampers the potential of the network to foster users' Social Capital (European_Schoolnet, 2010).

So far, AHTGs have been tested in two different settings. The first one is a distance learning situation with a structured open course (Van Rosmalen, 2008). The second one encompasses several situations, ranging from a taught course in a formal, face-to-face school setting to an open course in a distance learning setting (De Bakker, 2010). In the first case, an initial prototype of an AHTG service was constructed, and learners could use it to receive peer support or answer content-related questions through a group wiki workspace, somewhat similar to the one described above. A major difference between this experiment and the approach described in this Chapter is the community focus. The results of research by Van Rosmalen and

colleagues indicate that AHTGs enhance the extent of the social support received and provided. Also, the quality of the questions as judged by expert tutors was found to be satisfactory (Van Rosmalen, et al., 2008b). In the second case, once again a service, named 'WhoKnows,' was set up based on the concept of AHTGs. This service assigns students to competent fellow students and uses instant messaging to create a group space in which participants are able to interact. Here too, peers proved willing to answer their fellow students' questions and did so sufficiently well (De Bakker, 2010). Yet, here again the focus was solely on the support and not on the community aspect. Moreover, the 'WhoKnows' service used synchronous communication, whereas the approach discussed here uses asynchronous communication.

Discussion

The example discussed above shows how developers and users of OER could help each other to deploy those resources more efficiently and effectively. It also shows through what mechanisms communities could be formed around OER. At first, such communities might be provisional ones which would last only as long as a particular user struggles to resolve a particular issue. However, such AHTGs could seed the growth of longer-lasting groups, perhaps even communities of people who interact on a regular basis and work collaboratively on a shared goal. Julia, for example, through asking a series of questions about dealing with gender issues in her class, could get in contact with a small group of people with similar interests, revealed to her by the peer support service. With some of them she could decide to remain in touch on a regular basis, thus constituting a community of gender issue experts-to-be. It is easy to see how such a community may evolve into a full-blown community of practice (see Figure 3.5). As Julia and her peers ask questions, their connections will spread out in a decentralized way. It is important to note that the connections established are not just between Julia and the peers who helped her, but also between the peers themselves. This is believed to be a vital and distinguishing element of the AHTG concept, when compared to traditional communication methods such as a forum. In a forum, connections would typically lead to a small group of central peers (DeSanctis, et al., 2003; Fetter, et al., 2008), whereas through AHTGs a more decentralized structure can be obtained (Fetter, et al., 2010a).
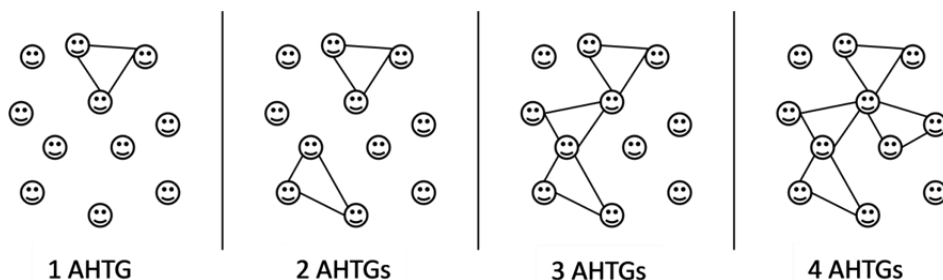
Figure 3.5 –Community Build-up through AHTGs

In the case of Julia, using AHTGs not only leads to her question being answered. Perhaps even more important is the fact that she has found others with whom she can exchange, people whom she (most likely) would otherwise never have met. Moreover, those who accepted Julia's question have now also met each other.

When designing such a service, it is sometimes all too easy to forget to ask the opinions of those for whom it is intended. Therefore, doing a stakeholder analysis was vital before any real implementation could be done. This analysis proved to be very useful in three general ways: (a) there was the consensus that the proposed AHTGs service would be a valuable addition to the eTwinning network, (b) there was valuable feedback on layout, usability, and the wish for the option to send a message to those peers who had helped, and (c) there was a strong opinion against rating fellow eTwinners. The criticism of such rating was especially important, as it had been suggested in earlier work that rating was an important factor in an AHTGs service (Fetter, et al., 2009). While the stakeholder analysis provided valuable feedback, using this approach does limit the number of people who can be asked. In our case it is pertinent to ask whether the opinion of 22 participants should indeed influence the service planned to such a degree. The present design, however, should only be considered a first draft. Monitoring the eTwinners and their usage patterns will provide valuable feedback later on.

As discussed previously, the use of peer support in OER is not new. It is the combination of aspects in AHTGs that makes it a novel approach. For the examples discussed involving OpenLearn and P2PU, the use of AHTGs might prove to be a valuable addition in the future. The use of AHTGs in these networks could have many different functionalities. For example, one can imagine using AHTGs being used to find the right users to collaboratively initiate a new course. Another example would be the use of AHTGs during the actual courses themselves, providing users with another method of asking questions. A final example would be to use AHTGs throughout these networks as a more general way of asking questions on how to

properly use the network and its functionalities. This approach could, for instance, lead to the creation of a Frequently Asked Questions (FAQ) list over time and therefore expand the support provided in this way.

Conclusions

When talking about OER, there is more to the story than just having the resources in an open repository. As we have argued in this Chapter, the community underlying these OER is just as important, if not more so. Without a community, the necessary aspects of collaboration and sharing are difficult to facilitate. Indeed, as Margaryan and Littlejohn already argued a few years ago (2007), the repository approach needs to be augmented with a community approach or risk failure.

As is put forward in this Chapter, peer support is ideal for offering support to OER users (especially in a non-formal context). In addition, peer support can, if facilitated properly, stimulate the growth of the community and help it to become more sustainable. This is exactly why we argued for the extensive use of AHTGs in the context of the development and use of OER. Having people help each other in a small, closed environment, using matching techniques to find the right peers, should result in three main benefits for the community: (a) improved relationship characteristics, (b) a heightened sense of connectedness, and (c) more mutual support. Put succinctly, it adds to Social Capital.

The scenario thus outlined has focused on peer advice on how to work with and deploy OER. However, it is easy to see how a similar service could work for peer review and assessment of OER, for peer collaboration to create or gather OER, and for peer creation of OER metadata: the service would then be instructed to match a particular resource with prospective reviewers, assessors, developers or librarians, respectively. Of course, the details of these configurations may vary widely, but the effect that the service would achieve would in all cases be temporary collaboration in AHTGs to start with and, possibly, the formation of long-lasting communities of practice and increased Social Capital as an end result. Clearly, these end results are not only sought after by OER networks. It should come as no surprise that we believe the concept of AHTGs is promising in any situation in which peer support is a viable option. One could imagine a Facebook application that uses a similar system to allow people to find one another and ask questions; or at LinkedIn, to find those you need to obtain a future job. In fact, the website 'Aardvark' (http://www.vark.com) already uses something similar to AHTGs and allows people to ask questions of each other, with great success. So while the OER approach is a great place to start, our approach is definitely not limited to it.

Future research

The examples discussed show the potential of AHTGs for peer support and for fostering the community aspect of both formal and non-formal learning situations. Currently a new version of the AHTG service is available, and is being tested with eTwinners at the time of writing (2011). As eTwinning provides many OER and is primarily a non-formal learning environment, it is ideal for testing AHTGs. This pilot will run for three months and includes approximately 690 eTwinners. Participants are split up over three groups, namely, an AHTGs group, a Forum group, and a Control group. In this pilot, we will compare these groups' ability to foster Social Capital. Data will be gathered through logging and questionnaires; social network analyses will also be used. Altogether this should give us valuable insight into whether the specific service (and AHTGs in general) has the desired effect on fostering Social Capital.

Research in the more distant future will need to go in multiple directions. Firstly, if proven useful, the AHTGs service will need further tweaking before possible integration into networks similar to eTwinning can be envisaged. Especially the question of how to use a matching system in such a large network will be challenging. Secondly, it would be interesting to test AHTGs in existing OER networks which are struggling with their community buildup or use AHTGs to start a community from scratch and watch the effect on the community's Social Capital as compared with alternative methods. Finally, future research in AHTGs should take the concept into the larger social networks. Considering the amount of knowledge and data that is present in these networks, AHTGs could work very well in many of these networks for a variety of purposes.

Chapter 4

The eTwinning Network

Introduction

Learning Networks are technology-supported communities through which learners share knowledge with each other and jointly develop new knowledge. This way, Learning Networks enrich the experience of formal, school-based learning as well as form a viable setting for non-formal professional development and lifelong learning (Sloep, Berlanga, Greller, Stoyanov, Retalis, Klink, & Hensgens, 2011). Examples of Learning Networks for professional development are networks of employees who want to improve customer services, lawyers who want exchange knowledge and experience, or networks of teachers who exchange their experiences and seek collaboration.

A case in point is the European project *Teacher's Lifelong Learning Networks* (Tellnet), which aims to study an existing network of teachers (eTwinning) in order to support development of their competences by managing and handling large-scale data on social networks. Furthermore, in the context of this project tools are investigated to foster peer-support and collaboration as well as increase social capital in the eTwinning network.

As part of a range of studies on fostering social capital in Learning Networks (Fetter, et al., 2010a), in this study we follow an approach where we start from a theoretical basis and end up with a prototype tested and adjusted in an existing network. We give special attention to the view of the future users as well as the actual impact the introduction of AHTGs are expected to have. Founded on earlier reports provided by eTwinning, as well as results obtained from the Tellnet project, a picture is drawn of the current state of the network with regard to participants' awareness of each other and their sense of connectedness to each other. Based on this picture, AHTGs are introduced and their role in changing the network is explained. Finally, we reflect on future research regarding AHTGs.

The eTwinning Network

eTwinning[2] is defined as the network for schools in Europe. It promotes teacher and school collaboration through the use of Information and Communication Technologies (ICT). In other words, the eTwinning network (over 120.000 users) is a large online environment in which teachers can work with each other and learn from each other. Through this network, collaborative projects can be started on a wide variety of subjects. They range from improving teaching skills of math teachers to having multiple primary school students working together and learning about different cultures

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[2] www.etwinning.net

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(Fetter, et al., 2010b). At present eTwinning undergoes a transitional phase. Since the beginning of the eTwinning action in 2005, its main purpose was the facilitation of collaborative school projects across borders in Europe, whereas since 2008, its aim has broadened towards the delivery and maintenance of a social network for teachers (Vuorikari, 2010; Vuorikari, Gilleran, & Scimeca, 2011). In parallel, the eTwinning platform has gone through major changes. New social networking features have been added to the platform to allow eTwinning teachers (eTwinners) to do projects, to socialize, to extend their professional network and to improve their teaching skills (Vuorikari, 2010). The socialization of the network is, therefore, paramount to eTwinning's future development.

In the following part, we outline a view on eTwinning using various sources. By combining different approaches and data, we can build up a meaningful current status of eTwinning. The following information is explained:

- Monitoring report of eTwinning in 2009.
- Survey measuring the sense of connectedness and general connectivity (n=795).
- Social network analyses (data from the eTwinning platform).

Monitoring Report eTwinning 2009

In December 2008, eTwinning conducted a survey asking eTwinners about their opinions on and actions in eTwinning. The survey was conducted online in 22 different languages. In total, 1308 eTwinners responded (Crawley, et al., 2009). The 2008 survey revealed a clear distinction between primary (2/3) and secondary school teachers (1/3). Also, while many different topics are taught (e.g. Mathematics, ICT, Literature), the topic Foreign Languages clearly dominates the survey, accounting for 44.3% of the teachers. Looking at the data extracted from the eTwinning platform in June 2010, we can further define the subjects taught by eTwinners. While there are more than 20 different subjects that the teachers indicated in the data, four are most common ones, namely Foreign Languages, Language and literature, ICTs and Maths (see Table 4.1).

Table 4.1 – Main teaching subjects

Subject taught	N	%
Foreign languages	57,782	9.2%
Language and literature	19,508	3.1%
Informatics/ICT	15,609	2.5%
Mathematics/Geometry	13,829	2.2%
Other	524,272	83.1%

A second classification can be based on the reason for registration as this provides insight into the different goals eTwinners have. In the 2008 survey, the four main reasons for registration were:

- Help students meet other students (main).
- Meet other European teachers.
- Find partners for projects/Comenius actions.
- Improve teaching skills.

The survey also finds that eTwinners came into contact with eTwinning initially either through colleagues, teacher training activities, or by browsing the Internet.

A third classification can be made based on whether or not an eTwinner has participated in a project yet. As explained previously, before 2008, the idea of cross-border school collaboration projects was the main driver for joining eTwinning. Out of the 1308 2008 survey participants, 1024 or 78.3% had already participated in an eTwinning project. This means that the respondents to this survey consist of the core eTwinners who are active in project collaboration among many other activities in eTwinning. The data from the platform collected in mid 2010, shows a reversed trend; a small percentage of teachers collaborate in the projects whereas the majority have no involvement in the project work (73% of the eTwinners had not yet participated in a project), while of those that did half participated in multiple projects.

- Most respondents in the survey of 2008 indicate that they are satisfied about the coordination with partners and almost all participants (>95%) who were in a project were satisfied with eTwinning in general. Moreover, they report that the projects impacted their teaching practice in numerous ways, for instance:
- Making it fun.
- More interest in taking part in future projects.
- Improvement of ICT skills.
- Improving foreign languages and communication skills.
- Learning about other school systems.
- Learning new teaching techniques.
- Improving skills to work in interdisciplinary teams.

There are however challenges to overcome during a project. Such as:

- Lack of time.
- ICT problems.
- Difficult to find a partner.
- Difficult to organize the work online.
- The user friendliness of the eTwinning platform.

Sense of connectedness

Sense of connectedness (SOC) represents how well someone feels connected to others and feels he or she is part of a community (Rovai, 2002). As part of an ongoing experiment a survey was conducted to better understand the SOC of the eTwinners, their characteristics and online behaviour.

The survey was based on the SOC questions proposed by Rovai (2002). eTwinners were invited to participate when they taught one of the major topics as shown (see Table 4.1). In the end, 795 eTwinners filled in the survey. Obviously, this is only a subset of eTwinners, who can be classified as active as they have to come to their desktop to see the invitation.

The questions in the questionnaire were internally consistent with a Cronbach's Alpha of .822. The main result of the survey is that the majority of respondents feel well connected with an average of 6.65 on a 10 point scale (SD= 1.2). Interestingly, the SOC is positively correlated with the number of projects responding eTwinners were involved in $r = 0.22$, $p < 0.001$. Also, SOC was positively correlated with the number of months they had been part of eTwinning $r = 0.19$, $p < 0.001$. Unsurprisingly, the number of months and number of projects were also positively correlated with each other $r = 0.32$, $p < 0.001$.

Results also show that respondents indicate that around 50% of their eTwinning contacts are online contacts solely. In other words, many respondents have multiple contacts whom they meet face-to-face as well. This is an important result as it indicates that eTwinning should be seen more as a blended social network than a full-blown online social network. The fact that it is a blended network for a large group influences on how to interpret the visible social network. eTwinners, who might be labelled as isolates in the network based on project participation, could have a strong set of relationships based on face-to-face meetings and not be isolated at all.

A large proportion of the respondents think their amount of contact with other eTwinners is just right with a mean of 4.8 on a 9 point scale (Figure 4.1). Yet variation in this preference is high – it covers the whole range from 1 to 9. The majority of the respondents indicate they would like to have more contact with fellow eTwinners.
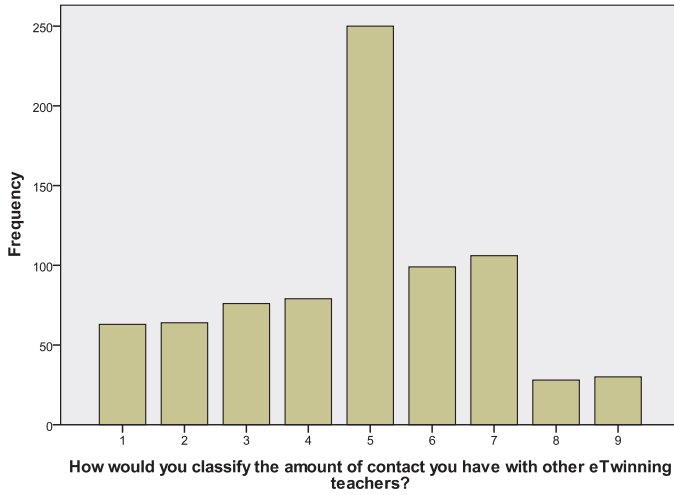
Figure 4.1 – Amount of contact (1- too litle to 9 – too much)

Most eTwinners made some new contacts in the past six months (see Figure 4.2) of which most were established "through the use of Internet". "Through the use of Internet", most likely referes to contacts that eTwinners can create using the eTwinning Desktop tools, but this cannot exclude other use of the Internet and especially social media, which is used by active eTwinners quite often (e.g. contacts could have been formed on the Facebook, too).
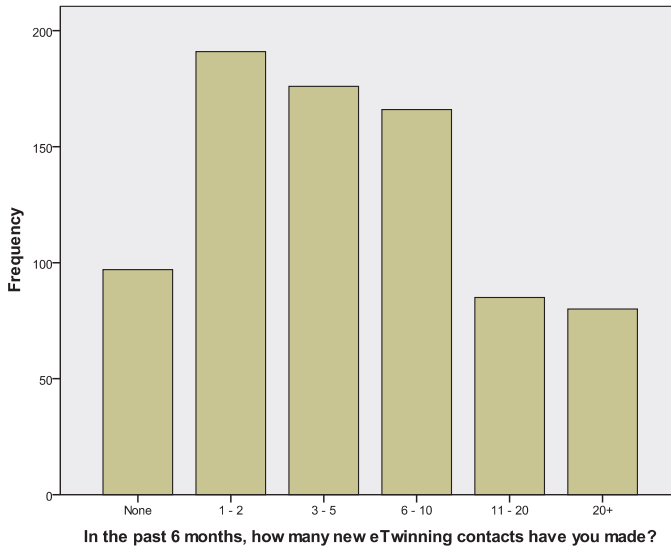
Figure 4.2 – New contacts made

In the six months preceding the survey, 42.5% of the eTwinners had been in contact with the eTwinning National Support Service (NSS) for support. In relation, 60.1% reported having had contact with other eTwinners for support. Most eTwinners prefer a mix of support of the NSS and their fellow eTwinners (Figure 4.3). Yet, to be three distinctive groups seem to prevail. On the one hand there are those who prefer support from the NSS. Then there are those who prefer support from their fellow eTwinners. Finally, the largest group prefers a mix. Interestingly, these preferences are not correlated with any of the other indicators measured.
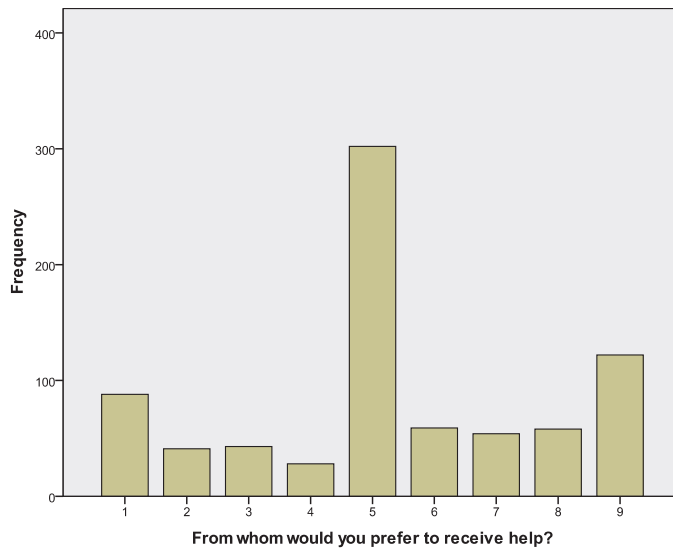
Figure 4.3 – preferred support ranging, (1 – Fellow eTwinner to 9 – eTwinning Support Service)

Social Network Analyses

Based on a datadump provided by eTwinning, Social Network Analyses (SNA) were conducted. In order to understand better the current state of the network, a set of questions was constructed. In the following part, a subset of questions is selected to conduct the first SNA to provide a deeper insight into the underlying relationships. The following four questions were selected for the first round of the SNA to test the analysis tools. The analyses were performed by colleagues from the RWTH University in Aachen, Germany (TellNet, 2011).

Question 1: When looking at the project collaboration network, is it possible to divide the network into sub-communities and if so, what is their relation to the rest of the project collaboration network?

Even if the project collaboration does not constitute the most important part of eTwinning since 2008, studying the project collaboration network, its structure and core using the SNA measures gives insights into how possible new mechanisms could be created to help other networks to grow in the future.

Through the analysis, RWTH was able to identify 2776 separate clusters (see Table 2). These clusters are formed through eTwinners collaborating in projects. First observations show that there are four very large clusters that create the core of the eTwinning project collaboration network. The biggest one contains 8807 eTwinners, two other clusters with about 3000 and one of 1172.

Apart from these large clusters, there are many small clusters. As Table 4.2 shows, 2627 of them consist of 2 to 9 eTwinners. It seems that the small clusters are those of people who collaborate only on one project during the time they have been part of eTwinning, the cluster size most likely corresponding to the number of the project partners.

Table 4.2 – eTwinning network clusters – created by RWTH

Cluster size (N eTwinners)	Number of times identified
8807	1
3669	1
3175	1
1172	1
100-1000	9
10-100	136
2-9	2627
Total:	2776

What we can understand from the clustering formation is that, for example, in the largest cluster, there is a group of eTwinners who have collaborated with each other in a high number of projects where partnerships create complex ties among themselves. Moreover, we see that there are four sub-communities in the core of eTwinning.

Lastly, RWTH calculated the modularity of the clustering. The modularity indicates the quality of the cluster, a fraction of any node's connections within its cluster (internal edges) and its connections to other clusters (Pham, Cao, Klamma, & Jarke, 2011). Empirical observations indicate that a modularity greater than 0.3 corresponds to significant community struc-

tures. In our analysis, we observe a modularity of 0.4, indicating significant community structures.

> *Question 2: When looking at the project collaboration network, how dependent is the eTwinning project network structure on a small core group of eTwinners?*

The analysis was done based on the projects eTwinners participated in at the time of the snapshot, i.e. in mid 2010. eTwinners who did not participate in project collaboration were excluded from the analysis. Figure 4.4 shows a typical degree distribution that follows a power law, therefore indicating that the project network is scale-free. In a scale-free network one can usually observe a few big hubs followed by many small clusters (Schnettler, 2009).

This means that the project collaboration network is dependent on core eTwinners that can be seen as bridges (hubs) between different clusters. Nodes with a higher degree tend to have a lower clustering coefficient (clustering decreases when degree increases). That means lower-degree nodes are placed in dense groups (clusters) and these clusters are connected via hubs (nodes with high degree). However, as the betweenness is quite low (less than 0.1) there are apparently no super-hubs who exclusively connect the clusters. Clusters are typically connected via several hubs. In conclusion, although eTwinning is dependent on a core group, this is a large and well-connected group.
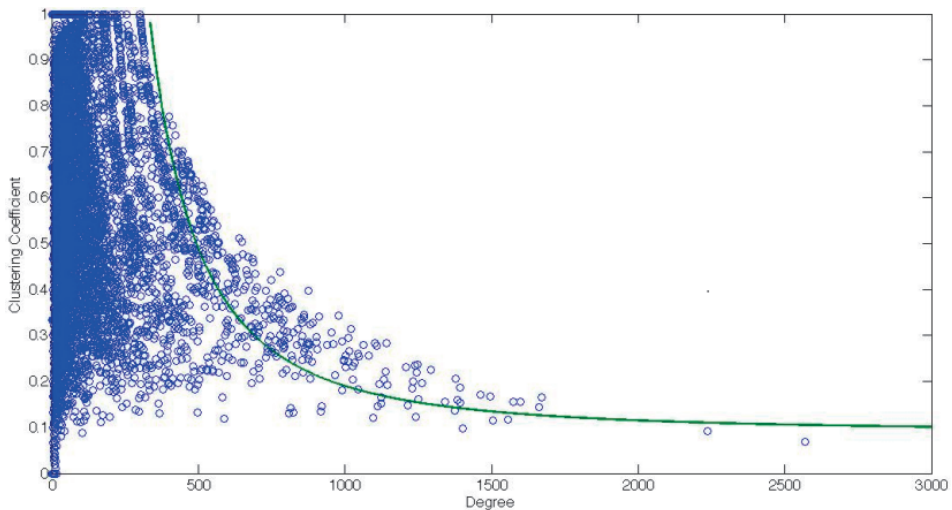
Figure 4.4 - Project Clustering vs. Degrees – created by RWTH

Question 3: Over the years, how many eTwinners have gone inactive and were these eTwinners individuals who were connected through the project collaboration network?

The eTwinning platform uses different indicators to calculate "inactive" teachers, i.e. teachers who for example have not logged in onto the eTwinning platform during a predefined period of time. At the time of the snapshot, in mid 2010, out of the 114.020 (at that moment registered) teachers, 2750 individuals have been flagged as "inactive", resulting to 2,4% of all participants. The degree and clustering coefficient was calculated for these teachers. From the degree distributions, we can see that they follow a power law, the same as distribution in Figure 4.4. Actually, inactive teachers seem just a sample of the same distribution of the whole network. This distribution also holds when RWTH constructed a network based on the blogs or the emails the teachers produced. The fraction of teachers who have clustering coefficient equal to NaN (Not a Number; means that they have only a connection - degree = 1), is 17.5% (project collaboration network), 49.01% (blog network) and 63.41% (email network). 41.4% of the inactive teachers do not have any activity in these (project, blog or email). Even for those who took part in various networks (projects, blog or email), they are quite isolated (as they have low degree and are placed in small, possibly disconnected, groups).

Question 4: eTwinners can create lists of MyContacts on their Desktop adding interesting people to the list for possible future collaboration. Is there any evidence that teachers have added people from different countries in their contact lists?

As eTwinning by nature promotes cross-border collaboration, we also find that in "MyContacts", eTwinners overwhelmingly have added people from countries other than that of their own. If the creator of the list has a value of 0, it means that all contacts are from other countries, and 1 means that all contacts are from the same country. The mean for all eTwinners who had "MyContacts" is 0.16, indicating a strong preference for incorporating eTwinners from other countries in their lists. Figure 4.5 shows that only a fraction of contacts are within the same country.
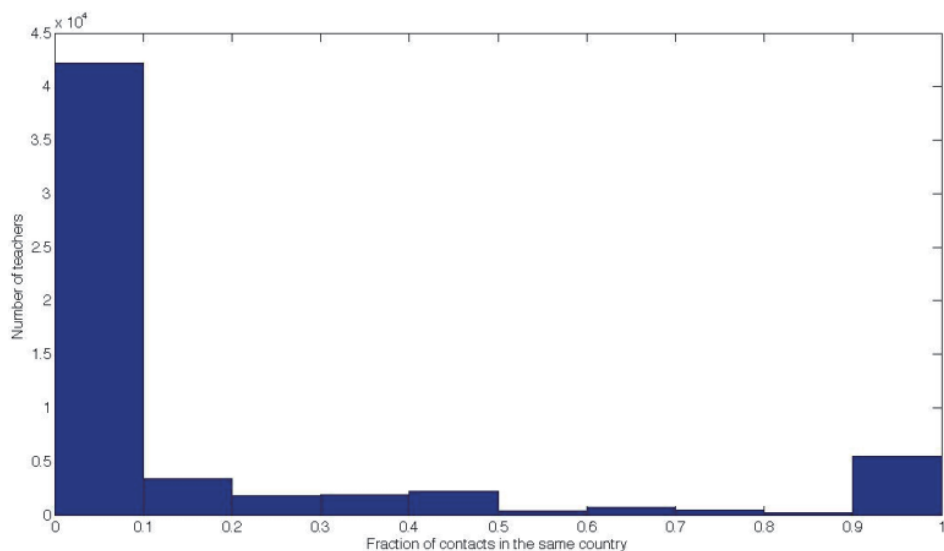
Figure 4.5 – Fraction of contacts in the different country than that of the e-Twinner (bar on the left) and in the same country (bar on the right). – created by RWTH

Network picture

Given the data just presented, we can now paint a picture of the state of eTwinning. The results can be discussed from the eTwinners' and from the global perspective. We first discuss them separately and then combine them to give an overall conclusion. This then leads to a discussion of future work.

eTwinners' Perspective

As we found a strong core group found using the SNA methods, it is not surprising the eTwinners who responded on the sense of connectedness survey report that they have a rather high sense of connectedness, on the average, 6.65 on a 10-point scale. The likelihood that the respondents on the survey mainly belong to the core group is also reflected in the many new contacts they made in the six months preceding the survey. Only a few of them reported having made no new contacts whatsoever. The new contacts made in the last six months were primarily made online; yet it was reported that half of their contacts are not based solely on online situations. This reflects that eTwinning is a blended network, a network which combines online interaction with face-to-face interactions at for instance eTwinning conferences. The impression obtained is that those eTwinners who invest time and participate in school collaboration projects are likely to become

part of the core group. Once they are in the project collaboration network there are many incentives and contacts to keep people active. From this we conclude that the way the core group is organized provides a good base for eTwinning's future improvements and sustainment.

Yet, these results need to be seen in the perspective that most respondents of the survey are probably part of the active and connected part of eTwinning. Typically, surveys are unlikely to reach those people who are inactive, and this case is no exception. Due to the restrictions to use personal information, the data used by the project partners have been anonymised. This means that there is no way to identify a real teacher or a real school in the data without the consent of the individual. However, the results give us a good insight in the core eTwinners and shed some light on those that currently are not connected in any of the identified networks.

Finally, some eTwinners clearly prefer to receive support solely from the Central and National Support services and the others only from fellow eTwinners. Yet the majority prefers a mix of the two.

Global Network Perspective

As one can see from the numbers of eTwinning teachers, it is a large, fast growing community of schools and teachers in Europe. Most of the eTwinners remain active in eTwinning, meaning they log in at least once every 6 months. From the network point of view, to study eTwinning, evidence of collaboration between users is needed. In our case, we use the eTwinning platform to gather this evidence. At first, we looked at networks that were created through project collaboration, through contacts, use of internal messaging. Looking at the project collaboration network, we find that 73% of eTwinners are not connected. This may indicate that many eTwinners are not aware of each other, as they are not collaborating and interacting with each other through the platform. But note that interactions might take place outside of the platform. Those we cannot account for, though, in the Tellnet studies.

From the network point of view, this raises the concern that the network is very dependent on a small core group of users. When a network depends on a small core group, it is prone to fall apart when one of these core members drops out (Fetter, et al., 2010a). While the data show eTwinning is indeed dependent on a small core group, the SNA also shows this should not be a concern:
- The core group consists of thousands of people.
- The core group consists of many communities.
- These communities are linked together through many connections rather than only through specific eTwinners.
- The fraction of "inactive" teachers is relatively low.

Therefore, we may say that the core group of eTwinning is a strong and well-connected group, which provides a stable basis for future development and sustainability of the network. At the same time, however, many eTwinners remain unconnected to the project collaboration network, meaning that on the eTwinning platform we cannot show any type of interaction with others through these networks. From the perspective that lurking is not necessarily a bad thing, this does not have to be problematic per se (Neelen & Fetter, 2010).

As an overall conclusion, the eTwinning network has established a strong core group that is well interconnected and supported. We believe that this core group will provide eTwinning with a strong base for the future. However, as this core group has been established using the snapshot of data, it also shows that a large number of eTwinners are not connected to the core network. Therefore, we suggest that now is the time not only to expand the connections in the network, but also to interconnect the networks further. eTwinning therefore now needs to focus on the eTwinners who are not part of the core network yet and efforts should be made to connect them to the core group. The use of peer-support mechanisms, such as the AHTGs tool described in the following section, in our view will improve the collaboration, sense of connectedness and social capital of the eTwinners.

Chapter 5

Using Peer-Support to Connect Learning Network Participants to Each Other: An Interdisciplinary Approach

Introduction

In online learning networks it is imperative that participants are connected to each other. Being connected allows participants more readily to learn and develop. To take this point further, one can argue that for a Learning Network to build up and sustain its communities, it needs to foster its Social Capital (Fetter, et al., 2010a). Social Capital represents the relationships people have between them and the benefits that can be obtained by building on these relationships (Burt, 2005; Portes, 1998). To foster Social Capital in a Learning Network it is especially important to develop three pillars of Social Capital, namely: *Relationship Characteristics* – how are people connected*, Sense of Connectedness* – do people feel part of the network*,* and *Mutual Support* – are people using the established relationships (Fetter, et al., 2010a).
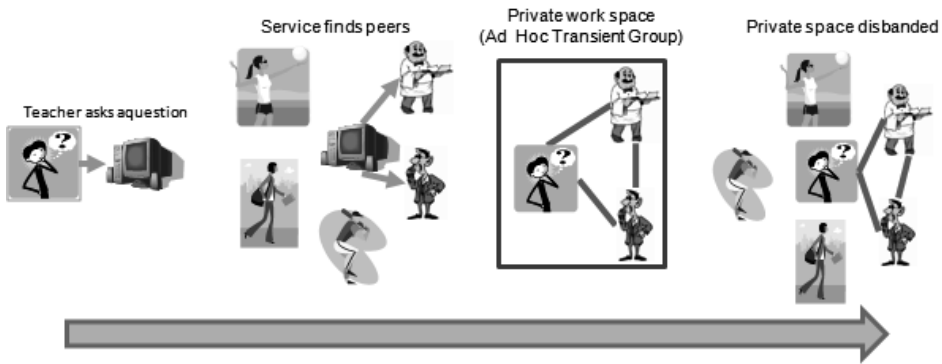
Figure 5.1 – Ad Hoc Transient Groups

Sleep (2009a) proposes to use a peer-support mechanism called Ad Hoc Transient Groups (AHTGs) to foster social capital. The idea behind AHTGs is to create many short-term moments of contact between different combinations of participants within a network (Berlanga, et al., 2008) in order to increase in number and decentralization of relationships between participants. It is also expected that by introducing AHTGs the sense of connectedness will increase and that the mutual support between participants be enhanced. In Ad Hoc Transient Groups (AHTGs) participants that have a request are helped by other participants in a dedicated private space ('adhoc') and for a limited amount of time only ('transience') (Figure 5.1). The nature of the request depends on the participant's needs as well as the network. Requests can be questions about factual knowledge or best practices. Yet, requests might also be doing a short term class project together or reaching out to others purely from a socialization point of view. To date work on AHTGs has focused on relatively small groups (Van Rosmalen,

Sloep, Brouns, Kester, Koné, & Koper, 2006). However, we feel that these results cannot be directly translated to large scale networks.

In this paper we report on a large-scale experiment where we introduced a peer-support service using AHTGs to teachers of the eTwinning Learning Network. The eTwinning network (http://www.etwinning.net) consists of more than 130,000 teachers (named eTwinners) from all over Europe. Through this network, eTwinners come together to complete projects ranging from providing their students opportunities to learn from each other to improving their own teaching practices.

This study tests the hypotheses that introducing AHTGs in a Learning Network will have the following main effects (Fetter, et al., 2010a):
• Improving Relationship Characteristics (Coleman, 1990).
• The number of relationships increases.
• The weak/strong relationships balance shifts towards the weak relationships.
• The relationships spread out in a decentralized way, rather than in a typical star pattern.
• AHTGs positively influence the Sense of Connectedness (Rovai, 2002).
• Mutual Support increases (Kester, et al., 2007).

To measure whether the introduction of AHTGs had a measurable effect, a No-Intervention group was used. However, as this is the first time AHTGs are used in a existing network an additional group was included which had access to a Forum instead of the AHTGs. As Forums are well known in eTwinning (and in general as a peer-support tool), we surmised this would provide a good benchmark. An interdisciplinary design was chosen as we agree with Molenaar (2010) in that interdisciplinary approaches are severely lacking in the research field on Social Capital.

In the following section we discuss our methodology, including participants and provide a short description of the prototype used. In addition, we explain which measurements have been taken. Thereafter, the results of the experiment are reported and discussed, including limitations. Finally, general conclusions are drawn and future research is elaborated upon.

Methodology

Participants

In preparation of this experiment, an eTwinning datadump was used to identify which eTwinners would be most appropriate to include in the experiment. This datadump was obtained through the TellNet project (http://www.tellnet.eun.org) and included the profiles and usage logging of all eTwinners over the previous five years. The new datadump was especial-

ly made for this experiment at the pre- and post-measuring times. Based on this datadump we made the decision to invite eTwinners who teach in one of the four main eTwinning teaching topics. Invitations were sent out via a newsletter and were included on the eTwinning personal page. The invitation included links to the pre-measurement questionnaire which was administered via Google Docs. All invitations and questionnaires were available in four languages (English, French, Spanish, and German). As explained in the invitation, completing the questionnaire was also an agreement to participate in our study and provided us the necessary authorization for linking the participants' email to the IDs as present in the datadump. This was needed for identification, measurements, and matching data for those in the AHTG group.

In total, 819 pre-questionnaires were completed. After matching the thus obtained email addresses with the eTwinning database and after the removal of duplicates, 691 participants were left (see Table 5.1). Participants who taught one of the four teaching topics mentioned above were randomly divided over the AHTG and Forum group until each group consisted of 230 participants. The remaining 231 participants were assigned to the No-Intervention group. Once assigned, participants in the AHTG and Forum groups received an invitation to start using the prototype. Participants in the No-Intervention group received an email explaining that they were in the No-Intervention group. It should be noted that participants in the No-Intervention group still had full access to eTwinning and its communication/collaboration tools. After the experiment, all participants received another email inviting them to fill in the final questionnaire. For the AHTG and Forum group this included an evaluation of the software service as well. The post-questionnaire was filled in by 375 participants (AHTG=103, Forum=118, No-Intervention=154). All subsequent analyses that used data from the questionnaire only used participants who filled in both questionnaires.

Table 5.1 - Participants at Pre- and Post-measurement

		N	English speaking in percentage	Average months in eTwinning	Average number of projects
Pre	AHTG	230	97%	24.5	5.7
	Forum	230	95.2%	25.8	5.6
	No-Intervention	231	97.8%	24.3	5.2
Post	AHTG	103	97.1%	29.6	7.8
	Forum	118	95.8%	28.6	5.9
	No-Intervention	154	98%	27.8	5.5

Tools

In order to facilitate the use of AHTGs, a peer-support service was created (Fetter, et al., 2009). In addition, a built-in Forum of our testing environment was used. All participants in both the AHTG and Forum groups were asked to complete a profile.

AHTG group

The service creates small groups of peers with similar interests and problems (i.e. an Ad-Hoc Transient Group). Before they used the service, participants were invited to follow a tutorial (made available via Slideshare) and respond to questions in their profile with some relevant information (months active in eTwinning, number of projects, languages spoken and teaching experience). Once the profile was filled in, the participant could go to the application and ask his or her question (Figure 5.2) or, if they were invited to do so, answer the question of someone else.

Figure 5.2 – Asking a question

To ask a question, participants had to fill in a form as shown in Figure 2. Next to a short title and an explanation of the question, participants had to choose the subject of the question and indicate in which language the question was written. Regarding the subject, participants had six options to choose from, specifically: About eTwinning, Projects, and the four teaching topics participants were selected on. After completing the form, the service's matching system (see Figure 5.3) generates a list of participants who it estimates are likely to be able to help, including the matching scores that

represent their suitability (see Figure 5.4). To find the most suitable participants, the matching system takes into account all the information derived from the eTwinning datadump (e.g. Language preferences, number of projects, time active in eTwinning), the subject and language of the question, and the profiles of others (see Figure 5.3 for the whole algorithm). The service then calculates sub-scores, which are accumulated into a single matching score. Sub-scores are provided based on the following categories (Fetter, et al., 2012a):

- Availability: The number of satisfactory answers given by a particular participant relative to the average number of satisfactory answers given by all participants. Thus, the more requests a participant has accepted and answered, the lower his or her availability score is.
- Content competency: Participants whose expertise area is/are similar to the question category receive a positive sub-score.
- Similarity: A correlational score is calculated based on the participants' subject(s). The higher the correlation, the more similar they are.
- Language: Based on the language of the question, only those participants who have the same language selected in their profile are considered in the matching exercise.

Figure 3 shows the matching algorithm. Once the overall matching score is calculated, the service creates a list with the top 25 best matches (Figure 5.4). The participants can then choose from this list and invite others to help, or they can let the service do this for them. In the latter case, email invitations are sent out to the first three participants who appear on the list. The invitation includes the description of the problem and a request to join a shared workspace. If the participants invited do not reply within three days, or if they decline the invitation, the service sends out invitations to the next three participants on the list. The process stops either when a sufficient number of participants accept or the list has been depleted and insufficient numbers of peers have indicated their willingness to help. In case participants chose the manual option, the invitational emails are only sent to those marked. In case of no response, no new invitations are sent.

It is important to stress that the addition of the manual invitation option was only included in the system after a stakeholder consultation in a workshop on the eTwinning Conference Sevilla in 2009. Participants in this workshop were well-connected eTwinners who were knowledgeable about the network and their fellow eTwinners. They stressed the importance of eTwinners having the ability to choose whom to invite to answer questions. Taking this feedback into account together with the fact that at the time the design for the tool assumed large numbers of participants, it was deemed worth the risk of inclusion. We argued that the chance of having known participants presented through the matching was sufficiently low when considering the size of the eTwinning network.
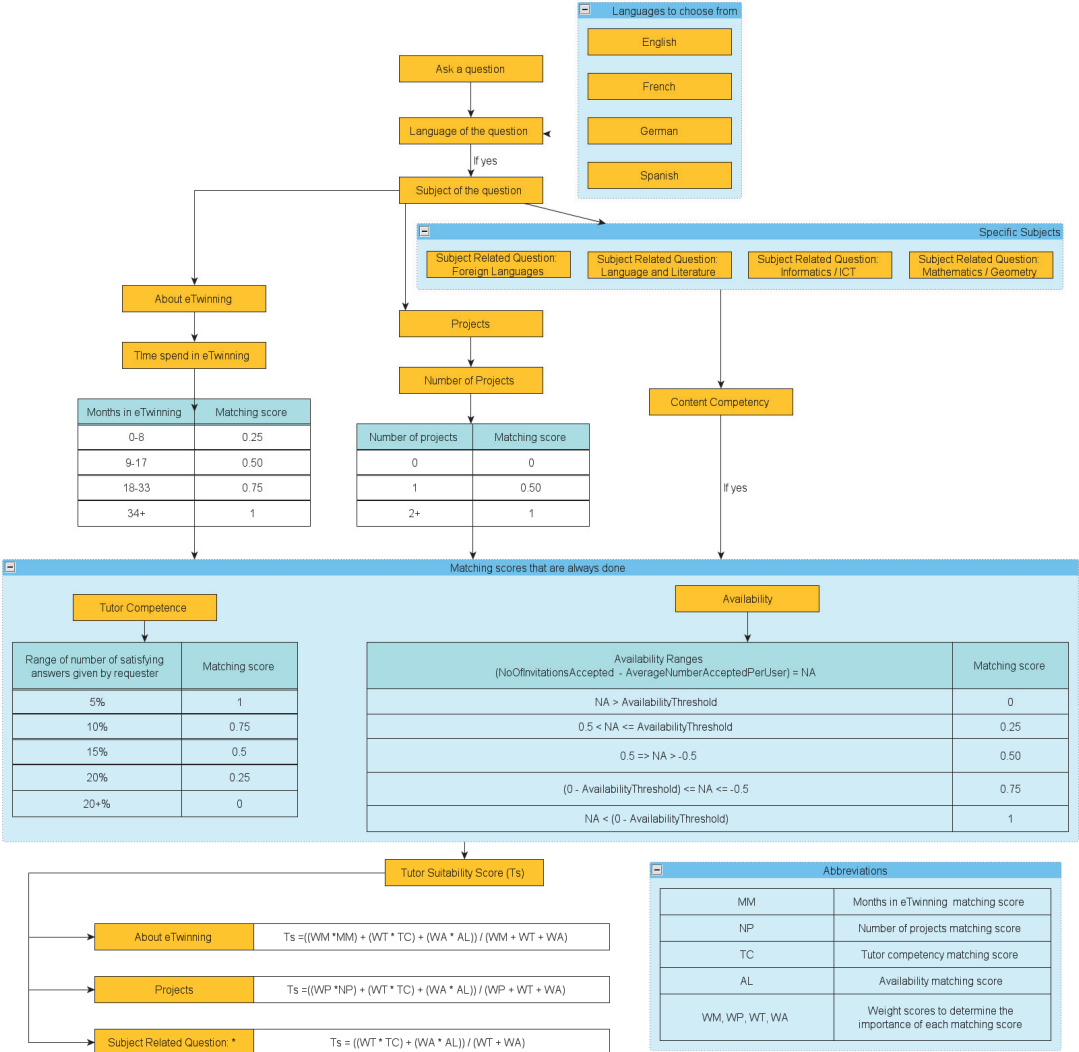
Figure 5.3 - Matching Algorithm

Invite people from the list below:

Include	Exclude	People		Suitability
☐	☐		Name: Test4 Test Gebruiker4 Answers:0	0.5
☐	☐		Name: Test3 Test Gebruiker3 Answers:0	0.42
☐	☐		Name: Test6 Test Gebruiker6 Answers:0	0.33
☐	☐		Name: Test5 Test Gebruiker5 Answers:0	0.25
☐	☐		Name: Test2 Test Gebruiker2 Answers:0	0.17

|◄ |◄◄ | ◄ | ► | ►► | ►|

5 people found, displaying 5, from 1..5, Page 1/1.

| Invite Selected People | Choose for Me | Help |

Figure 5.4 – Finding Participants

Once accepted, these participants and the questioner thus form an AHTG. In the workspace, they discuss the question that was posted and interact with each other to clarify it.
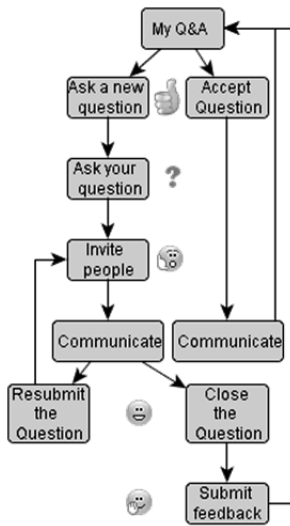
Figure 5.5 – Flow chart

Participants have access to AHTGs through the "My Questions and Answers" screen. This is the main screen of the service. It gives access to:
• the currently active question with its associated group space;
• a list of recent activities (questions asked and answered);
• the list of current collaborators;
• a box through which one can ask new questions (Figure 5.2);
• general preferences for the service;
• a flow chart as a reference for participants (Figure 5.4).

Once the question has been discussed to the questioner's satisfaction, he or she can flag the question as closed. If no answer was given, or the answer was unsatisfactory, the questioner can either resubmit the question or close it and flag it as answered unsatisfactorily. Upon closing the question, the questioner is asked to provide feedback to those who were involved and the participants who participated in the AHTG are added to the "people I worked with" list.

Forum group

The Forum group used the same Liferay environment as did the AHTGs group, except that they had a built-in forum instead of the AHTGs prototype. Separate tutorials were made using Slideshare. As a preparation, the Forum was filled with six threads corresponding with the topics participants could choose in the AHTGs group (no new topics could be added by participants). Participants were instructed to start a new post for every new question asked.

Measurements

Relationship Characteristics

In order to test the hypotheses regarding the Relationship Characteristics, a Social Network Analysis (SNA) approach is taken. Through the use of SNA it is possible to measure and compare the spread of the relationships. In addition, these analyses can provide the number of relationships between participants and their strengths. Relationships (called 'degrees' in SNA terms) between the eTwinners were calculated for each group, based on a datadump provided by eTwinning before and after the experiment. For the AHTG and Forum groups, relationships gained through the service were added. The number of relationships was based on eTwinners' contacts, posts they left on each others' personal message wall, as well as with whom they worked together in a project. For each contact, post, and shared project the relationship between two participants was increased by 1. For example, an eTwinner who has someone in their contacts (+1), posted something on their wall (+1), and once completed a project with this eTwinner (+1), would have a relationship with this eTwinner of strength 3.

Testing our hypotheses with regard to the relationship characteristics is not straightforward. While measurements like the number of relationships and number of unique relationships are comparable across groups and over time, measuring the network dependency on a small core group is not. The main reason for this is that the measurements available are used for connected networks, where isolates (participants with no relationships) are either not present or ignored. However, as isolates cannot be ignored for our hypotheses, we need to use these techniques with more care. Over time isolates might become connected to the network through new relationships. However, this can make it statistically seem as if the network becomes more dependent on the core group, rather than less (as would actually be the case). In order to test for the centralization hypothesis, a number of different approaches are used in combination with each other, so a clear picture can be drawn of each network and any possible changes occurring over time. First, we examine measurements that can be approached using parametric tests. These data (see Table 5.2) can be obtained directly from the network and can be compared using standard statistical analyses. With regard to the classifying of relationships as weak or strong, we chose to classify all relationships which had been used only once as weak, and all other relationships (used more than once) as strong. In addition, this classification also made sense when looking at the data as 0-1 relationships accounted for 57.4 % and 2+ relationships accounted for 42.6% of the participants.

Table 5.2. Measurements allowing parametric testing

	Explanations
Relationships	Number of relationships, where stronger relationships add multiple relationships
Unique Relationships	Number of unique relationships
Weak Relationships	All relationships with a relationship of 1
Strong Relationships	All relationships with a relationship of 2+
Isolates	All participants with no relationships
Density	The existing relationships across all possible relationships

The second group of measurements is derived from the network using UCI-NET (https://sites.google.com/site/ucinetsoftware/home) and provides a more in depth look at the role of each participant. These measurements are participants' flow-betweenness, Clustering coefficient, and their level of constraint. Flow-betweenness is an adaptation of the classical betweenness measurement from Freeman (Freeman, 1978). Freeman's Betweenness is based on the shortest paths between participants in the network. It gives an estimate of how dependent the network is on some core participants with respect to the flow of information through the network. However, communication flow often does not follow the shortest path. Therefore the Flow-betweenness also takes into consideration alternative paths (Newman, 2005). Like Freeman's betweenness, this calculation produces a value for each participant, indicating overall the network's dependence on a small number of participants for the information to be able to flow throughout the network. The clustering coefficient reflects how well each participant's neighbors are connected. This gives an indirect insight into the growth of the network and the relationships established (Soffer & Vázquez, 2005). The constraint measurement indicates the importance of the participant's connections to others who are interconnected between each other as well (Burt, 2005). In other words, if a participant has a low constraint, this means that her connections are also connected to each other.

Finally, descriptive statistics and visualizations are utilized to represent our network. For this, NetDraw (as part of UCINET) was used. We analyze how many participants are connected to the largest component in the network and how this changes between pre- and post-measurement. Using UCINET a k-core analysis is run which determines which participants belong to which groups (component) and how many participants are part of each component. The main information gained from this analysis provides an insight into how many participants are connected to the heart of the network.

Sense of Connectedness

To measure the Sense of Connectedness participants experienced, we adapted the Classroom Community Scale developed by Rovai (2002). This questionnaire consists of two subscales: Sense of Connectedness and Sense of Learning. For our analyses only the Sense of Connectedness subscale was included (original α = .92). Questions were altered to fit the eTwinning network and the 5 point Likert scales were changed into 9 point scales (1-strongly disagree to 9-strongly agree) for the scales to be in line with the other questions which were on a 9 point scale. Questions were also added to the Sense of Connectedness questionnaire to measure participants' connectivity in the eTwinning network. These measurements are used as extra information for interpretation of the results, especially those of the SNA.

Mutual Support

Mutual support reflects the number of questions asked as well as the number of answers given and the general willingness to help. To measure mutual support we looked at (a) the number of questions asked, (b) the number of answers given, (c) the ratio between a and b, and (d) the number of unique participants asking / answering a question. Data is obtained through logging embedded in the AHTG tool and Forum.

Results

Relationship Characteristics

Parametric tests

First we checked whether there were overall differences between groups on the *'Relationships'*, *'Unique Relationships'*, *'Weak Relationships'*, *'Strong Relationships'*, and *'Isolates'* variables. This was confirmed with an MANOVA (WilksLambda= .95, $F_{(10,1368)}$= 3.84, p<0,001).

Table 5.3 shows that there are multiple significant interactions between groups. For each significant interaction, a difference score was calculated. ANOVAs with post-hoc tests (Bonferroni corrected) were conducted to specify the exact differences between the groups.

Pairwise comparisons with Bonferroni corrections, revealed multiple significant differences between groups. First, the Forum group gained significantly more relationships and unique relationships than either the AHTG (p < 0.01) or No-Intervention (p < 0.01) group. When looking at the weak and strong relationships, participants in the Forum group gained more weak

relationships than the AHTG (p < 0.001) and No-Intervention (p < 0.001) group. At the same time, both the AHTG (p < 0.01) and Forum (p < 0.01) group gained equally more strong relationships than the No-Intervention group. Regarding the clustering coefficient, both the Forum (p < 0.01) and AHTG (p < 0.05) group had a significant decrease compared to the No-Intervention group, but no difference was noted when compared with each other.

Table 5.3 shows that there are multiple significant interactions between groups. To test in what way the densities changed, bootstrapped, paired t-tests were run in UCINET. For each test a bootstrap of 100 random network samples was used in order to ascertain that differences found were not due to random network distribution. Results show that the AHTG t(229) = 2.24, p < 0.05 and Forum t(229) = 4.37, p < 0.01 group significantly increase in density, whereas the No-Intervention t(230) = 2.05, p > 0.05 group does not.

Non-parametric tests

Due to their interdependent nature, the variables as shown in Table 5.4 could not be compared using parametric tests. Therefore, non-parametric Related-Samples Wilcoxon Signed Ranks Tests were used to identify whether means differed over time. If significant, this was followed up by Independent-Samples Kruskal-Wallis Tests to identify whether this difference was group dependent.

Table 5.4 shows a significant increase in flow-betweenness and clustering coefficient. At the same time there was a significant decrease for the constraint variable. However, the follow-up tests revealed that only for the clustering coefficient was there a significant effect of group. Follow-up pairwise comparisons, Bonferroni corrected, reveal a significant increase in clustering coefficient for both the AHTG (p < 0.05) and Forum (p < 0.01) group when compared to the No-Intervention group. No difference in increase was found between the AHTG and Forum group.

Table 5.3 – Interaction effects between the independent variable difference scores and groups using a Mixed ANOVA Repeated Measures

Measurements	AHTG		Forum		No-Intervention		F	η^2	Sig.
	Pre	Post	Pre	Post	Pre	Post			
Relationships	3.38 (6.2)	5.57 (9.54)	2.97 (5.38)	7.1 (11.3)	3.17 (5)	4.5 (7.06)	11.105	.032	p < 0.001
Unique Relationships	2.76 (4.82)	4.54 (7.56)	2.5 (4.33)	6.21 (9.77)	2.65 (4.49)	3.96 (6.34)	11.792	.029	p < 0.001
Weak Relationships	2.14 (3.57)	3.58 (5.97)	2.04 (3.45)	5.42 (8.51)	2.25 (3.71)	3.44 (5.71)	12.354	.030	p < 0.001
Strong Relationships	0.62 (1.51)	0.96 (2.09)	0.45 (1.26)	0.8 (1.7)	0.45 (0.85)	0.51 (1.01)	6.332	.017	p < 0.01
Isolates	0.38 (0.49)	0.33 (0.47)	0.48 (0.5)	0.43 (0.5)	0.44 (0.5)	0.41 (0.49)	1.130	.031	p > 0.05

Table 5.4 – Comparison results for the interdependent variables on the Related-Samples Wilcoxon Signed Ranks Tests (RS) and Independent-Samples Kruskal-Wallis Tests (IS).

Measurements	AHTG		Forum		No-Intervention		(RS) Test Stat.	(RS) Sig.	(IS) Test Stat.	(IS) Sig.
	Pre	Post	Pre	Post	Pre	Post				
Flow-betweenness	0.17 (0.43)	0.20 (0.49)	0.15 (0.32)	0.16 (0.30)	0.15 (0.33)	0.16 (0.34)	35.376	p < 0.001	0.513	p > 0.05
Clustering Coefficient	0.21 (0.41)	0.30 (0.51)	0.14 (0.32)	0.25 (0.37)	0.22 (0.4)	0.24 (0.41)	18.485	p < 0.001	11.819	p < 0.01
Constraint	0.35 (0.38)	0.32 (0.36)	0.27 (0.36)	0.22 (0.32)	0.31 (0.37)	0.29 (0.36)	10.570	p < 0.001	2.018	p > 0.05

Descriptive Results

The descriptive results are composed of a largest connected component analysis and network visualizations (Figure 5.6). The largest connected component analysis was run in UCINET. The results (see Table 5.5) show that for all groups the number of components went down and the number of participants connected to the largest component increased. Yet, the results also indicate that where the proportion of participants connected to the largest component stays the same for the No-Intervention group, it increases for both the AHTG and Forum group.

Table 5.5 - Largest connected component results

Measurements	Components		Participants in largest component		Proportion Participants in largest component	
	Pre	Post	Pre	Post	Pre	Post
AHTG	96	86	128	140	0.56	0.61
Forum	114	101	113	130	0.42	0.57
No-Intervention	108	101	118	126	0.55	0.55

Sense of Connectedness

The pre- and post-measure Sense of Connectedness questionnaire was filled in by 375 participants. The Cronbach's Alpha of the pre- and post measurement were .822 and .857 respectively. According to our hypotheses, we expected the AHTG and Forum group to increase their Sense of Connectedness and the No-Intervention group to stay the same. However, a mixed ANOVA showed a negative significant difference over time for all groups $F(1, 372) = 6.124$, $p = .014$, $\eta^2 = .016$ (see Table 5.6). In addition, there was no significant difference between groups at pre- $F(2, 372) = 0.244$, $p = .784$, $\eta^2 = .001$ or post- $F(2, 372) = 0.077$, $p = .951$, $\eta^2 < .001$ measure. T-tests were run for each question separately in order to check whether there were differences between the groups on question level. No differences were found between groups. Further follow-up analyses showed that specifically participants with a higher initial sense of connectedness filled in the post-questionnaire $F(1, 372) = 3.61$, $p = .058$.

	Pre	Post
AHTG		
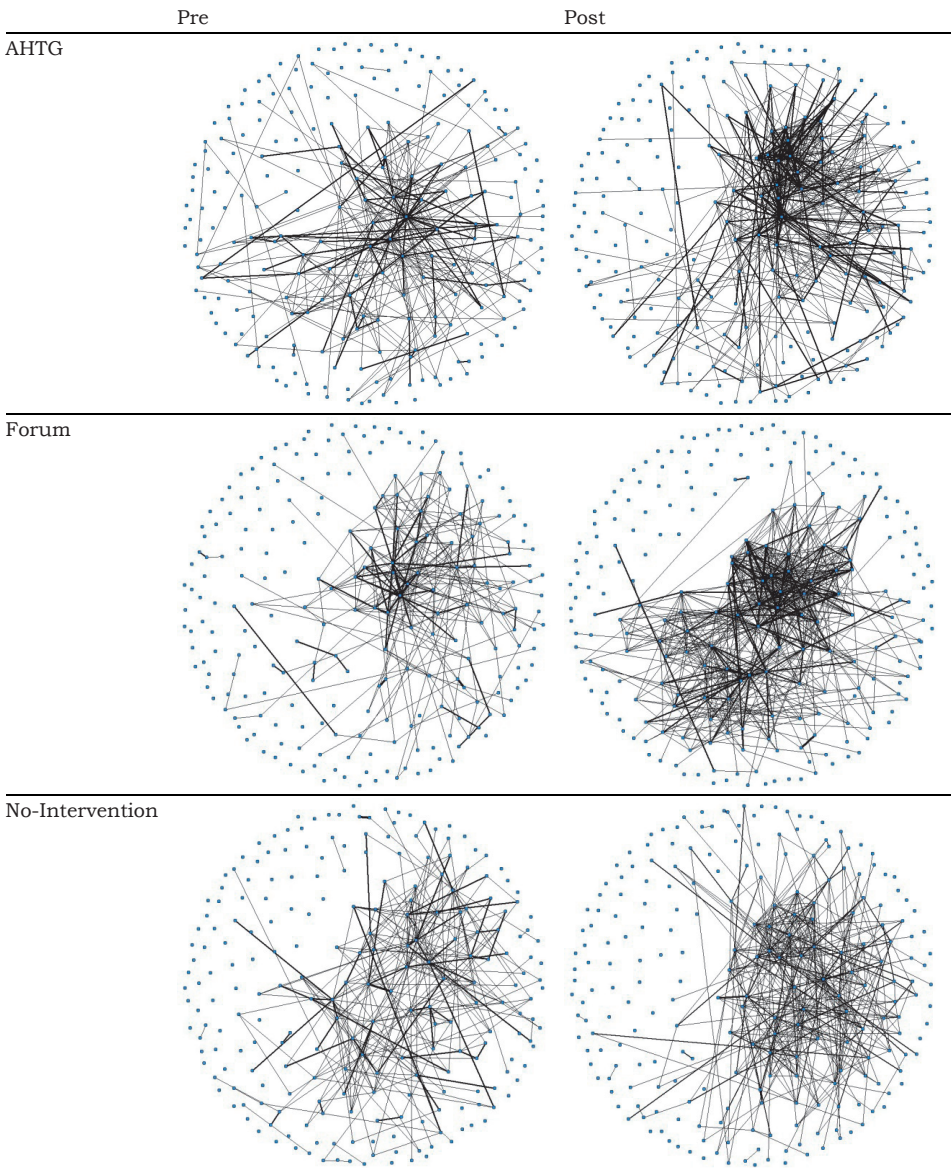
Figure 5.6 - Network visualizations

Table 5.6 - Means of pre and post-measurements of sense of connectedness on a 1-10 scale.

	Mean Pre-measurement	Mean Post-measurement	Difference	N
AHTG	6.86 (1.15)	6.73 (1.27)	-0.13*	103
Forum	6.85 (1.10)	6.68 (1.19)	-0.17*	118
No-Intervention	6.77 (1.18)	6.69 (1.25)	-0.08*	154

* $p < 0.05$

Mutual Support

A MANOVA confirmed (WilksLambda= .925, F(4,455)= 9.24, p<0,001) that there were overall differences between groups on the '*Questions*, '*Answers*, '*Participants asking a question*, and '*Participants answering a question*' variables. More in depth, as can be seen in Table 7, participants in the AHTG group asked significantly more questions than did the Forum group, t(458) = 2.247, p = .025, *d* = .210. In addition, significantly more individual AHTG group participants asked a question compared to the Forum group, t(458) = 3.482, p = .001, *d* = .325. Interestingly, while asking fewer questions, the Forum group had a significantly higher number of answers t(458) = -2.512, p = .012, *d* = .235. However, having more answers did not result in having more individual participants answering. Although not significantly so t(458) = 1.548, p = 0.122, *d* = .145, these results rather seem to indicate that while giving fewer answers, more individual participants in the AHTG seem to provide answers compared to the Forum group. As the large difference in number of answers is clearly related to the number of individual participants answering, a follow-up analysis was conducted including the number of answers as a covariate. Indeed, the number of answers had a significant influence as a covariate on the number of individual participants answering F(1, 457) = 149,051, p < 0.001, η^2 = .245. Furthermore, after correcting for the number of answers covariate, the difference in individual participants answering became significant F(1, 457) = 10.192, p = .002, η^2 = .017. In other words, once corrected, more individual participants provided an answer in the AHTG group than in the Forum group.

Table 5.7 - Mutual Support Results

	AHTG	Forum	Difference
Questions	135	64	71*
Answers	131	393	262*
Participants asking a question	54	25	29**
Participants answering a question	50	37	13

* p < 0.05 ; ** p < 0.01

Evaluation and Additional Questions

Additional Questions

As there were no differences between groups with regard to the additional questions asked, results were pooled together in order to identify possible overall changes (see Table 5.8). Interestingly, as can be seen from the results in Table 5.8, there was a general decline in contacting other eTwin-

ners. Other interesting results are that our respondents seem content with the type and amount of contact they have with other eTwinners. Finally, eTwinners seem to prefer a mix of support (official eTwinning support and their peers) and are very willing to help other eTwinners.

Table 5.8. Additional questions results

N = 375	Pre	Post	d	Difference
In the past 6 months, with how many eTwinning teachers did you have contact?	4.10 (1.41)	3.93 (1.41)	.121	-0,17**
How many of these contacts do you see regularly face-to-face?	1.86 (1.12)	1.83 (1.16)	.026	-0,03
How many of these contacts are mainly online?	3.31 (1.41)	3.19 (1.42)	.085	-0,12
How would you classify the amount of contact you have with other eTwinning teachers?[a]	5.03 (1.85)	4.94 (1.83)	.049	-0,09
In the past 6 months, how many new eTwinning contacts have you made?	3.44 (1.43)	3.10 (1.45)	.236	-0,34***
How many of these new eTwinning contacts have you made through the use of internet?	3.25 (1.42)	2.96 (1.41)	.205	-0,29***
In the past 6 months, how many times have you contacted the eTwinning support service for help?	1.81 (.92)	1.65 (.88)	.178	-0,16***
In the past 6 months, how many times have you contacted other eTwinners for help?	2.01 (.98)	1.98 (1.02)	.030	-0,03
In the past 6 months, how many times have you been contacted by other eTwinners for help?	2.31 (1.29)	2.22 (1.28)	.070	-0,09
From whom would you prefer to receive help?[b]	5.53 (2.30)	5.52 (2.32)	.004	-0,01
How willing are you to provide help to other eTwinners?[c]	7.82 (1.63)	7.66 (1.62)	.098	-0,16

[a] 1 – too little to 9 – too much
[b] 1 – 'ETwinning Support Service' to 9 – 'Fellow eTwinners'
[c] 1 – Not willing at all to 9 – Very willing
* $p < 0.05$; ** $p < 0.01$
Reported values are means with Standard Deviations between brackets

Evaluation

The results of the evaluation can be seen in table 5.9 below. While in general positive about the AHTGs, the Forum was clearly evaluated better.

Table 5.9 - Mutual Support Results

	AHTG	Forum	d	Difference
Overall, the support provided by the 'Ask anything' service is relevant to my eTwinning activities.	5.54 (2.20)	6.11 (1.94)	.275	-0.57*
Overall, I believe that the 'Ask anything' service provides adequate support.	6.07 (1.99)	6.69 (1.70)	.335	-0.62*
Overall, I believe that the 'Ask anything' service is useful.	6.42 (2.05)	6.92 (1.68)	.267	-0.5*
Using the 'Ask anything' service takes little time.	6.04 (2.07)	6.41 (1.66)	.197	-0.37
I did not have to wait long for an answer using the 'Ask anything' service.	5.03 (2.22)	6.00 (1.94)	.465	-0.97**
Overall, using the 'Ask anything' service requires significantly less mental effort to obtain answers than when using other eTwinning services.	5.40 (2.05)	5.99 (1.69)	.314	-0.59*
It is easy to learn how to use the 'Ask anything' service.	6.48 (2.08)	6.72 (1.84)	.122	-0.24
It is easy to navigate through the 'Ask anything' service.	6.21 (2.07)	6.64 (1.92)	.215	-0.43
Overall, I am satisfied with the 'Ask anything' service.	5.83 (2.12)	6.72 (1.85)	.447	-0.89**
Using the 'Ask anything' service makes eTwinning more interesting.	5.92 (2.20)	6.52 (1.84)	.296	-0.6*
I would like to use the service after the pilot.	6.23 (1.98)	6.74 (1.83)	.268	-0.51*
I would like to see an improved version integrated into eTwinning.	7.36 (1.69)	7.18 (1.63)	.108	0.18
I would recommend the system to other eTwinners.	6.62 (2.07)	7.15 (1.79)	.274	-0.53*

1 – Strongly disagree to 9 – Strongly agree
* $p < 0.05$; ** $p < 0.01$
N = 375
Reported values are means with Standard Deviations between brackets

Discussion

Relationship Characteristics

Based on the social network analyses carried out, three conclusions can be drawn: (1) Overall the AHTG group and the Forum group show signs of de-centralization, (2) the Forum group has a significant increase in weak relationships, whereas the AHTG group only has a significant increase in strong

relationships, and (3) the Forum group has a significant increase in relationships and unique relationships. Each of these main relationship characteristics results will be discussed below.

When looking at the visualizations (Figure 6), the decentralization seems most apparent for the AHTG group, followed by the Forum group. Evidence of decentralization is found in the density increases. As the results show, both the AHTG and the Forum group had a significant increase in network density, whereas the No-Intervention group had not. In relation, the increase in clustering coefficient shows that participants either connected to other already connected participants, or that their existing neighbours increased their number of connections. In addition, proof of decentralization for the AHTGs is also found in the higher number of individual participants who asked a question. Finally, the decentralization hypothesis is strengthened by the fact that for the AHTG and Forum group the proportion of participants who belong to the largest network component increased, whereas this remained constant for the No-Intervention group. Thus, the social network structure that emerged went in the opposite direction of the typical star-pattern (Jones & Czerniewicz, 2011). This direction is theorized to be beneficial for the stability of the social network structure as it makes the network less dependent on a small group of participants and thus fosters Social Capital (Fetter, et al., 2010a).

As expected, participants who were in the Forum group significantly increased their number of relationships as well as strengthened pre-existing ones. However, the increase in new relationships was not found in the AHTG group. Instead, there was a significant increase in the strengthening of existing relationships. This result is surprising as the use of a matching system was especially meant for participants to come into contact with unknown eTwinners.

The change in the ratio between weak and strong relationships is related to this. At the beginning of the experiment the ratio of weak and strong relationships was the same for all groups. Roughly speaking, this equalled a ratio of four to one, for each four weak relationships a participant had one strong relationship. However, this ratio clearly changed for both the Forum and the AHTG group. Whereas in the Forum group the number of weak relationships increased, in the AHTG group the number of strong relationships increased. A possible explanation for this unexpected result will be elaborated in the discussion on *Mutual Support* (below). For now, suffice to say, the large difference in the number of answers between the AHTG and Forum group has something to do with it.

While these findings need further research, the most likely explanation with regard to the AHTGs groups' increase in strong relationships seems to lie in the tool. As explained in the methodology section, we had included a separate step with regard to the matching where participants were able to

choose peers from a list or let the system do it for them. Nearly half the time (44%), participants choose to manually select their peers. It seems there is a fair chance participants chose those they already knew, thus undermining the initial goal of the matching system. This seems likely as nearly all participants are clearly active, core eTwinners with many pre-existing contacts. Yet, the tool was designed especially for those with little to no contact. However, as we were only allowed to use the newsletter and eTwinners' personal eTwinning page for invitations, the chances of actually reaching those with little to no relationships was small at best. Together with a limited number of participants per group resulted in quite high chances that the matching list would contain at least some known participants. However, as was mentioned in the methodology Chapter, we felt we had no choice but to include this manual option because of the results of the stakeholders evaluation at the eTwinning conference.

In addition, we had to conclude during the test-phase that the matching algorithm reacted too slowly. Participants' availability score was only adjusted after accepting a question, giving an answer, and the question being closed. As this process could take days, the matching algorithm would keep the same participants at the top of the matching list. So while the matching did provide different lists based on the categories, these lists were populated by the same participants as in the first days. While regrettable, this problem resolved itself to some extent over time as, questions were answered and closed.

Mutual Support

As mentioned above, one of the most eye-catching results is the staggering number of answers given in the Forum group, specifically when compared to the AHTG group. As the number of answers is of crucial importance in the social network analyses, this difference in answers has undoubtedly had a strong effect on these analyses. However, even with this difference in answers, the hypothesis regarding the increase in mutual support seems to be confirmed. Indeed, it is very clear from the results that participants in the AHTG group did not only ask more questions, they were also asked by more individuals. This finding is crucial for AHTGs as it shows that they enable participants to easily ask a question and, more importantly, has more participants join in. This is important, as once inactive participants become active, they tend to stay active (Neelen & Fetter, 2010)

In itself the difference in answers would have been a result indicating that a Forum elicits more responses. Yet, in hindsight we see that the most likely difference between the groups comes from the choice of keeping the AHTGs private and the Forum open. To clarify, in the AHTGs, only those invited were able to even see the question, let alone answer it. On the other

hand, in the Forum each question was available to all participants. We chose to keep AHTGs private, in order to lower the threshold for participants to ask questions. Yet, we had not anticipated that this would result in such a big difference in answers, especially from a Social Exchange Theory perspective which predicts that the larger the group (like the Forum) the higher the chance of diffusion of responsibility resulting in less response (Gleitman, Fridlund, & Reisberg, 1998).

Sense of Connectedness

The results on the sense of connectedness show a significant decline for all groups. This difference was uniform for all Sense of Connectedness questions. However, many participants did not fill in the second questionnaire, which might have had a distorting effect. It seems likely that some major influence in eTwinning itself is the reason for this negative change and could very well have snowed over any changes the Forum and AHTG group might have had. Indeed, we know that just before the experiment started, eTwinning was completely redesigned. As most eTwinners log in infrequently, the first exposure to the redesigned environment could easily have come only after our pre-measurement. At the same time, as we were only allowed to recruit participants through means normally only accessed by avid users of eTwinning, our sample typically did not have many participants with a low sense of connectedness. It is likely that a regression-effect occurred, that is, that our participants already had a high sense of connectedness which is unlikely to change significantly precisely because it already is at such a high level.

Evaluation and Additional Questions

As is clear from the results, the Forum group performed better than the AHTG group. Of special interest are the large differences between groups with regard to waiting times and satisfaction. The difference in waiting time scores strengthens the notion that the AHTGs matching algorithm worked too slowly as previously stated. The overall satisfaction difference is not surprising given how many questions in the AHTG group were unanswered. In addition, the lower satisfaction could also point to general user interface issues, which might have to be improved in future versions.

Conclusions

In this paper, we report on the first introduction of peer-support through Ad Hoc Transient Groups (AHTGs) in the existing large scale Learning Network

eTwinning. The aim of introducing AHTGs was to foster the Learning Networks' Social Capital. Specifically, AHTGs were hypothesized to improve the relationship characteristics, raise the sense of belonging to the community, as well as increase overall mutual support. These hypotheses reflect the interdisciplinary approach taken in this experiment. Methodologies used range from Social Network Analyses to Sociology and Data Mining. To date work on AHTGs has focused on relatively small groups. We would argue that the results of such studies could not be simply translated to or directly compared in the context of a large-scale Learning Network such as this. Therefore, we used an experimental design which included next to AHTGs and a No-Intervention group also a Forum group. The inclusion of a Forum was seen as a good comparison, as this is a well-known, established method for peer-support.

Overall we can conclude that the introduction of AHTGs shows clear signs of fostering Social Capital with regard to the mutual support and the relationship characteristics. As we have shown, AHTGs stimulate more individual participants to ask a question and thus potentially get involved. This is important, as once inactive participants become active, they tend to stay active. Furthermore, AHTGs had a decentralizing effect on the relationships between participants. Thus, the social network structure that emerged went in the opposite direction of the typical star-pattern. This direction is theorized to be beneficial for the stability of the social network structure and thus fosters Social Capital. In relation, AHTGs seem to foster Social Capital in different ways than the Forum. This leads to an interesting new hypothesis which suggests that Forums and AHTGs cater for different needs and might be most valuable in a Learning Network when presented together.

We suggest that future research should compare AHTGs and Forums directly, in order to gain a deeper understanding in what ways they both can benefit a Learning Network and how they work together. To this end, an experiment to address these issues has already commenced. Furthermore, as we were unable to properly test the Sense of Connectedness hypotheses, future research might want to start with more small scale experiments. Finally, improvements can be made to the matching algorithm and the AHTGs peer-support service. These changes will also be implemented in the previously mentioned experiment.

Chapter 6

Fostering Online Social Capital through Peer-Support

Introduction

For most modern professionals, learning has become an essential part of their daily routines (Littlejohn, Milligan, & Margaryan, 2012). Increasingly, professionals need to tap into networks, inside and outside their circle of colleagues, to find the knowledge and expertise needed to solve the problems they encounter in their professional lives (Johnson, 2008; Nardi, Whittaker, & Schwarz, 2000; Rajagopal, Joosten-ten Brinke, Van Bruggen, & Sloep, 2012; Sloep, 2013). They need to learn collectively. This learning is significantly different than school-based, formal learning, not only because one learns at the workplace (or at home) - that is, outside the confines of schools - but also because individuals set their own goals, yet interact with each other to achieve these goals (Eraut, 2004; Tynjälä, 2008). Online social networks, consisting of multiple (partially overlapping) communities centered on the users' learning (with each other through sharing resources, discussing issues, finding solutions) are environments that seem well suited to support professional learning (Sloep, 2009b).

However, networks as such are too large and too loosely organised for productive interactions spontaneously to arise with sufficient intensity (Dron & Anderson, 2014; Sloep, 2009a). Subsets of a network ('collectives', teams, communities) need to be formed, which are not only significantly smaller (tenths of people rather than hundreds or more) but are also characterised by shared goals and values (Dron & Anderson, 2014; Kozinets, 1999; Wenger, 1998). The formation of such communities nor the collaboration in them by their members comes about automatically. First, network participants need to be *incentivised* actively to participate: mere usage ('lurking') is not enough, actively contributing is required (Sloep, 2009a; Sloep & Kester, 2009). Second and particularly in large networks, it is not easy to *find* the right people with whom to form a collaborative community. In large networks, the number of people whom one only vaguely knows or doesn't even know at all is vast, sheer information overload prevents one to consider all candidates, resulting in perhaps missing the most suitable candidates for collaboration (De Choudhury, Sundaram, John, & Seligmann, 2008).

A solution often attempted to support online collaboration is the use of online forums (Laurillard, 2012; McDonald, 2007). Such forums feature threaded discussions which are archived for later perusal. So, a user wanting to discuss a particular topic posts a message with a suitable topic header. Others who happen to read the message may react to it. The message then is automatically filed under the same topic header. Subsequently, others may react and, if needed, the discussion may split into subtopics. Forums thus provide opportunities for interaction; they are also excellent repositories of past discussions. Provided they have good search facilities,

such discussions may be retrieved by searching through topic headers. However, in our view forums are ill suited to support the kind of group or team formation that is needed for collaboration (Stahl, 2006, p. 134). For this, people need to be brought in touch with each other, not people with content. A thread, being a collection of posts, can only be the starting point of a community if the thread readers decide to stay in touch. Forums do not support thread contributors in their efforts to form a community and start collaborating.

Research on learning in networked settings has taught us that, with the right mechanisms in place, group formation may be facilitated, a process which ultimately may lead to the establishment of genuine communities. This mechanism builds on the notion of Ad Hoc Transient Groups (AHTGs)[3] and it deploys a technology that helps to stock these groups with network members who are willing to and capable of supporting each other (Sloep, 2009a). AHTGs are incipient communities (for more details, see Fetter, et al., 2012b; Sloep, 2009a; Van Rosmalen, et al., 2008b). In them learners who have a question are helped by fellow learners in a dedicated private space ('ad-hoc') and for a limited amount of time until the issue they struggle with (some question) is resolved ('transience') (See Figure 6.1). Previous experiments showed that AHTGs are indeed capable of incentivising people to collaborate (De Bakker, 2010; Van Rosmalen, et al., 2006; Van Rosmalen, et al., 2008b). However, these experiments were carried out in settings of tenths of learners only, so the ability of AHTGs to create productive groupings of people in large-network settings remained to be tested. The present paper investigates this question. Moreover, to capture the benefits that accrue to the network as a whole (in contrast with the individual participants of AHTCs) the notion of Social Capital is introduced.
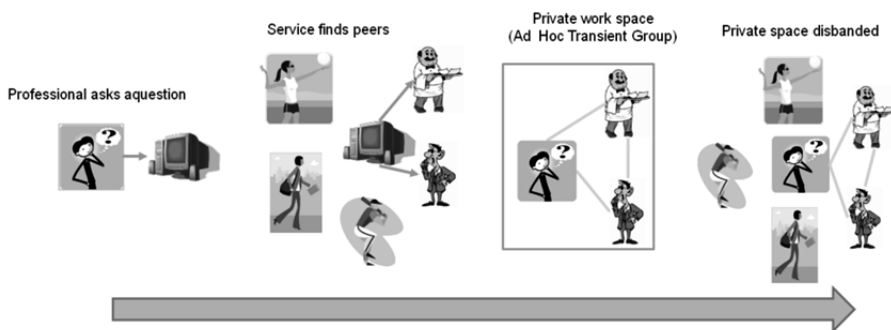
Figure 6.1 - Ad Hoc Transient Groups. The temporal flow of events in an AHTG is depicted here, with the arrow indicating the temporal order

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[3] This concept was first introduced as Ad-Hoc Transient Communities (Van Rosmalen, et al., 2006). To avoid the objection of suggesting a community to be present where none is yet, the term was changed (Fetter, et al., 2010a) into Ad Hoc Transient Groups (AHTGs).

Originally, AHTGs were designed as a form of peer-support and used specifically to alleviate the tutoring load of professional tutors (Kester, et al., 2007; Van Rosmalen, et al., 2006). The idea behind AHTGs was to create frequent instances of short-term contact across different combinations of participants within the network (Berlanga, et al., 2008), in an effort to stimulate knowledge sharing between learners. Although contacts in AHTGs are designed to be fleeting (the AHTG's ad-hoc-ness), they are likely to lead to a strengthening of relational ties between participants. This suggests that AHTGs may be used quite generally to strengthen the community structure of networks, which in turn would lead to more and better collaboration (Fetter, et al., 2010a). This effect can be measured as an increase in the network's Social Capital.

Social Capital represents the value that accrues to the relationships people have between them, it translates into benefits that can be obtained by building on these relationships (Portes, 1998). Benefits come in various kinds, ranging from pointing out a helpful resource to elaborating on discussions on sharing goals and solutions. Essentially, over time network members themselves become valuable resources to their fellow members (the 'social' in Social Capital).

In an earlier effort to test the claimed positive effect AHTGs have on Social Capital, Fetter and co-workers conceptualised Social Capital as consisting of three components: *Relationship Characteristics*, *Sense of Connectedness* and *Mutual Support* (Fetter, et al., 2010a). The more numerous and the stronger the connections, the more intense the sense of being connected to each other; also, the more abundant the mutual support, the larger the Social Capital. The then experiment looked into the effects the introduction of AHTGs had on any one of these components, using social network analysis to look into Relationships, and using questionnaires to gauge the Sense of Connectedness and the Mutual Support. The results provided evidence for an effect on Relationships and Mutual Support, but not on Sense of Connectedness. To probe further into this issue of Social Capital a different approach was needed. Therefore, the present experiment was set up, with the express aim to look into the Sense of Connectedness as well as into the specific and possibly mutually reinforcing roles AHTGs and forums have with regard to Social Capital. To this end, for the present experiment a qualitative approach was chosen rather than the quantitative approach, which focused on the participants' overt behaviour and was the topic of the previous experiment (reported in Fetter, et al., 2012b). The present qualitative approach is meant to provide insight into the thoughts and motivations of the eTwinners. It tests the following hypotheses:

1. eTwinners believe that using AHTGs will have a positive effect on fostering Social Capital, mediated through:

    a. Relationship Characteristics, such as establishing new connections and strengthening existing connections

    b. Sense of Connectedness, such as feeling that they are a member of the community and as increasing the interactions amongst eTwinners

    c. Mutual Support, such as increasing the benefits that can be obtained through connections and promoting continuous use of existing contacts.

2. AHTGs and forums are perceived as different from each other. That is, AHTGs will draw certain types of communication away from the forum, allowing the communication to be more focused.

3. AHTGs are at least as usable and accessible as forums.

The second hypothesis was included to ensure that AHTGs provided additional functionality, which could not equally well be provided by a forum. The third hypothesis was needed to make sure usability differences would not cloud the participants' judgements on AHTGs and forums.

In the remainder of this Chapter we first briefly describe the set up of the experiment and the methods used. A much more detailed account can be found in a report Fetter and colleagues produced for the EU funded Tell-Net project (Fetter, et al., 2011). Then, we focus on the findings of the experiment, discussing each of the three hypotheses in turn. Finally, we summarise our finding, address limitations of the experiment and discuss some opportunities for future work.

Experimental set up and data collection methods

The experiment was carried out with 112 members of the eTwinning network (http://www.etwinning.net). eTwinning is a network of teaching professionals that is supported by national ministries of education; it is open to all teachers across Europe. At the time of writing (May 2014), it supports over 251,115 teaching professionals in 122,414 schools. These professionals jointly carry out 33,538 projects, ranging from providing their students with opportunities to learn from each other to improving their own teaching practices. The large number of projects also makes eTwinning interesting from a generalisation point of view. Topics and methods differ vastly between projects and participants, making this a very diverse network. Teachers can work on small closed projects or on large-scale open-ended projects, whilst all have access to the more general forums and message-services (European_Schoolnet, 2010). All in all, these attributes make eTwinning a prime example of an online learning network, the results on which are likely

to be generalisable to other online networks for learning and professional development.

The software selecting who was going to collaborate with whom on a particular issue in a particular AHTG was called the *AHTG service*[4]. Over an 8-week period, participants were free to use the AHTGs or the forum, whichever in their view the occasion dictated. After this period, they received a questionnaire (see below). They were also invited to take part in a follow-up, structured interview, carried out via email. To allow for comparisons, only those participants who had used both the AHTGs and the forum were included in the analyses. This criterion, combined with the criterion that only participants who filled in both the pre- and post-test questionnaires, resulted in the inclusion of 84 out of the original 112 participants in the analyses.

Procedures followed

To submit a question to his or her peers via the AHTG service, participants had to provide a short title (much like a topic header in a forum) and an explanation of the question in a form. They then had to pick the subject of the question from a list of four topics and indicate in which language it was written (eTwinning is a multilingual network). As eTwinning is such a large network, topics were limited to the most crucial ones as found by (Fetter, et al., 2012a) namely: 'About eTwinning', 'Projects', 'Teaching practices', and 'Other'. Upon submitting these data to the AHTG service, it would start to find suitable peers, using a specific matching algorithm (for more details, see Fetter, et al., 2012b; Fetter, et al., 2011). Having found the three most suitable eTwinners the service would email an invitation to them. This invitation included the description of the problem and a request to join a shared workspace. If someone did not respond within three days, the service would send out and invitation to the next participant on its list. The invite process stopped if the list of possible participants had been exhausted or if a network participant posted an answer. Collectively, the participants formed an AHTG. In the workspace provided by the service, they discussed the question posted and interacted with each other to clarify it and (if possible) resolve it. After five days, further interaction was stopped automatically by the service. A transaction record was kept for archival purposes.

In total, 75 parcipants asked or answered a question using the AHTG service. In total, 47 questions were posed and 46 received an answer. Of the

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[4] In the experiment, it was called the Question and Answer (Q&A) service as AHTGs were deployed to allow people to ask a question to a selected group of others and receive answers by them.

46 questions answered, 27 (59%) had at least one discussant who had been invited via the matching algorithm that was part of the AHTG service. Only three questions required a second round of invitations.

As indicated, participants could also make use of a forum. It was filled with four threads that covered the same topics as did the AHTG service (no new topics could be added by participants). Participants were instructed to write a new post for each new question asked within one of the four threads.

Questionnaire

Using Google docs, a pre- (112 respondents) and post-questionnaire (86 respondents) was administered to the users of the AHTGs and forum. For each Social Capital component the questionnaire contained several questions. Questions were based on the results and lessons learned in our first experiment (Chapter 5) and were created for this experiment[5]. Participant agreement with the statements was measured using a 9-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (9). The questionnaire also contained statements about the usability of the AHTG service and forum; they were adapted from Venkatesh, Morris, Davis, and Davis (2003). Finally, questions were added to gauge a participant's general willingness to help as well as whether they preferred using the AHTG service or the forum.

Interviews

The network participants were invited to discuss 11 issues through structured email interviews (see the Appendix for the topics discussed). The topics of the interview were suggested by a first analysis of the responses to the questionnaires. The interviews were validated by five eTwinners who had participated in the previous experiment reported in Fetter, et al. (2012b). Four raters assessed the responses (options: positive, neutral, negative, missing). The intraclass correlation (model 2) between these raters was excellent with a correlation of 0.8 (Prasad, Udupa, Kishore, Thirthalli, Sathyaprabha, & Gangadhar, 2009)so a decision was made to ignore minority viewpoints. An independent fifth rater decided which viewpoint to report for those responses that exhibited no clear majority viewpoint.

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[5] The sense of connectedness questionnaire as used in Chapter 5 was not used here as its number of questions outweighed the other two Social Capital components.

Social Network Visualisation

To provide insight into the dynamics of the network's growth over time, a social network visualisation was made. Once the data collection was complete, a relationship matrix was drawn up for each question asked. Two participants who had the same answer were connected, whilst participants with different answers remained unlinked. For more details, see Fetter, et al. (2012b).

Results

Hypothesis 1 – Social Capital and its components

A one-sample t-test identified an overall positive, perceived influence of AHTGs on Social Capital (t(83) = 5.96, p < .001). This finding is in agreement with the results reported in Tables 6.1, 6.2, and 6.3 below, which detail the responses to the sub-scales of Social Capital. On all, participants were (moderately) positive.

Interestingly, while both the AHTGs and forum were seen as positively influencing Social Capital, the forum (M = 6.84, SD = 1.65) appears to have slightly more impact than the AHTGs (M = 6.25, SD = 1.92). This observation was confirmed in an ANOVA, which compared AHTGs with the forum (F(1, 166) = 4.56, p < .034, *d = .330*). Whether this reflects a genuine difference in appreciation or merely results from the participants' larger familiarity with forums remains undecided. Since forums have always been part of the eTwinning platform the latter explanation cannot be ruled out.

Participants reported a positive effect of AHTGs on Relationship Characteristics (Table 6.1). Participants tended to believe that AHTGs helped the establishment of new relationships and valued the possible benefits these relationships might offer. With a Cronbach's Alpha of .948 reliability of the Relationships Characteristics questions was excellent. The interview outcomes echo these results. Votes are split in half, though, over the question of whether AHTGs would help to strengthen existing relationships. Note that functionality to connect to existing relations was not included in the AHTG software as it expressly aimed to aid forging new relationships, assuming that strongly linked individuals will be able to find each other anyway.

Table 6.1 Relationship Characteristics Questionnaire and Interview Results; Relationship Characteristics Questionnaire uses a 9 point Likert-scale, midpoint of 5; 84 people filled out the questionnaire, 14 of them were subsequently interviewed; fractions refer to the fraction of them answering in the indicated fashion.

Relationship Characteristics questionnaire	n	Mean	Std. Dev.
AHTGs allow me to meet new eTwinners	84	5.95	1.98
AHTGs stimulate me to broaden my eTwinning network	84	5.99	2.12
AHTGs allow me to reach eTwinners whom I would probably not have met using other eTwinning services	84	6.29	2.18
AHTGs allow me to stay in contact with eTwinners I already know	84	5.94	2.13

Relationship Characteristics interview (n=14)	Positive	Neutral	Negative	Missing
Establishing new relationships between eTwinners	0.64	0.07	0.21	0.07
Strengthening existing connections between eTwinners	0.50	0.21	0.29	0
Benefits that can be obtained through interacting with other eTwinners	0.71	0.13	0.13	0

The positive influence of AHTGs on the Relationship Characteristics also shows up in the social network visualisations (Figure 6.2). While a core group can be distinguished, each new addition to the central group has multiple connections rather than one.
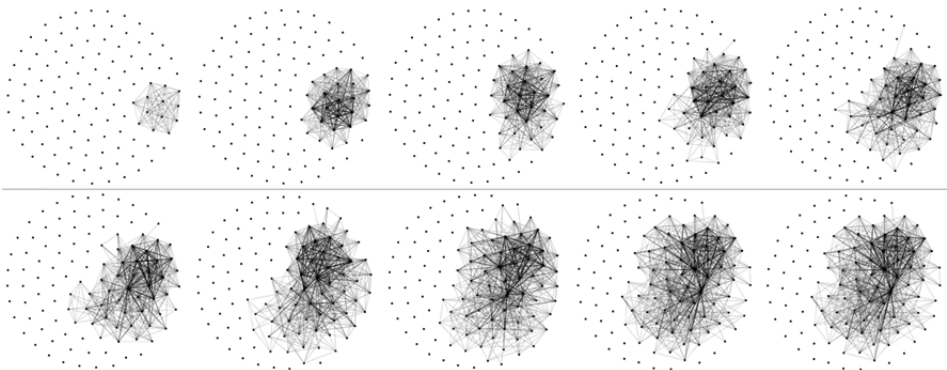
Figure 6.2 - Growth of the network over time using AHTGs (from left to right, top row first). Each step includes 5 new questions that were asked through the AHTG service. For each step, new links are pictured against the background of existing ones.

Second, most participants believe that using AHTGs will positively influence their individual Sense of Connectedness (Table 6.2). With a Cronbach's Alpha of .954 reliability of the Sense of Connectedness questions was excellent.Responses signalled in particular the importance of building a Sense of Connectedness for new participants. Although most interviewees were positive about the ability of AHTGs to promote a Sense of Connectedness (64%), about one fifth expressly denied this (21%).

Table 6.2 Sense of Connectedness Questionnaire and Interview Results; Sense of Connectedness Questionnaire used a 9 point Likert-scale; 84 people filled out the questionnaire, 14 of them were subsequently interviewed; fractions refer to the fraction of them answering in the indicated fashion

Sense of Connectedness questionnaire	n	Mean	Std. Dev.
Using AHTGs makes me feel being part of the eTwinning community	84	6.43	1.98
Using AHTGs makes me feel connected to other eTwinners	84	6.27	2.27
Using AHTGs keeps me involved in eTwinning	84	6.19	2.26
AHTGs allow new eTwinners to start participating	84	6.43	2.18
AHTGs prevent eTwinners from dropping out of eTwinning	84	5.71	2.36

Sense of Connectedness interview (n=14)	Positive	Neutral	Negative	Missing
The effect AHTGs will have on feeling part of the eTwinning network.	0.64	0.07	0.21	0.07

Finally, AHTGs are believed to have a positive influence on fostering Mutual Support (Table 6.3). With a Cronbach's Alpha of .942 reliability of the Mutual Support questions was excellent. Most participants indicated that AHTGs stimulate the intensity of interaction within the network. However, responses were mixed as to AHTGs' effect on the continuation of existing contacts. Some participants doubted AHTGs were suited for that. Interestingly, participants who indicated that the forum enabled them to stay in touch with established eTwinner contacts also gave a moderately positive score to the ability of AHTGs to retain contacts (N=84, Mean=6.50, Std. Deviation=2.24).

Table 6.3 Mutual Support Questionnaire and Interview Results; Mutual Support Questionnaire used a 9 point Likert-scale; 84 people filled out the questionnaire, 14 of them were subsequently interviewed; fractions refer to the fraction of them answering in the indicated fashion.

Mutual Support questionnaire	n	Mean	Std. Dev.
AHTGs make it easy for me to help my fellow eTwinners	84	6.46	2.18
AHTGs stimulate me to help my fellow eTwinner	84	6.40	2.37
Providing and receiving help is facilitated by AHTGs	84	6.69	2.04
AHTGs allow me to stay in contact with eTwinners I already know	84	5.94	2.13

Mutual Support interview (n=14)	Positive	Neutral	Negative	Missing
The intensity of interaction between eTwinners	0.57	0.21	0.21	0
Continuous use of existing contacts	0.36	0.21	0.21	0.21

Hypothesis 2, AHTGs and the forum

Questionnaire results indicate that most respondents would use either interaction platform (forum and AHTG) equally often, which seems to suggest

that they do not have a decided preference for one or the other (Table 6.4). However, the interviews seem to suggest that AHTGs and the forum were used for different ends. As one interviewee noted:

> *'Yes I Feel That the AHTG and forum are significantly different from each other, because on the AHTG I had a response rather quickly on a specific issue instead of on the forum it was possible talking about topics most extensively'*

And another said:

> *'...AHTG are for questions and forum allows for more discussion and the fleshing out of ideas'.*

Table 6.4 Difference between AHTGs and forums Questionnaire and Interview results. Meanings as follows. 1: only the AHTG, 2: Mainly the AHTG, 3 :Both equally often, 4: Mainly the forum, 5: Only the forum. 84 participants filled out the questionnaire, 14 of them were subsequently interviewed; fractions refer to the fraction of them answering in the indicated fashion

Difference between AHTGs and forums questionnaire question	n	Mean	Std. Dev.
If both the AHTG tool and the forum were provided, which would you use?	84	3.10	0.74

Difference between AHTGs and forums interview (n=14)	Positive	Neutral	Negative	Missing
AHTGS and forums are sufficiently different from each other	0.57	0.13	0.29	0

The interviews lend further support to the view that AHTGs and the forum cater for different needs in that most interviewees believe that introducing AHTGs will have a positive effect on forum usage (Table 6.5):

> *'It could be easier to find the right answer to your question. I think that you could spare time!'* (about AHTGs)

> *'I think both would be useful, because for a starter a new eTwinner could read AHTG and after that he could search the forum for some specific themes.'*

Table 6.5 Influence of introducing AHTGs on the forums, Interview Results; fractions refer to the fraction of interviewees answering in the indicated fashion

Introducing AHTGs interview (n=14)	Positive	Neutral	Negative	Missing
Influence of introducing AHTGs on the forums	0.57	0.13	0.21	0.07

Interviewees who were less positive about offering both AHTGs and a forum feared that combining them would require more time on their part. As one respondent noted:

> *'I don't use the AHTG service. For me there are now too many tools on the twinspace.'*

Hypothesis 3 Usability

Cronbach's Alpha for both usability questionnaires was .946 and .898 respectively. Participants scored both AHTGs (M = 6.74, SD = 1.75) and the forum (M = 7.03, SD = 1.60) high on usability (9-point Likert scale). This is fortunate as lack of usability often masks judgements about functionality (Davis, 1993). A follow-up ANOVA showed no detectable difference between AHTG and forum users (F(1, 166) = 1.29, p = 0.258) in this respect. The use of a matching mechanism was seen as a very useful addition. Most interviewees (9 out of 14, 64%) rated matching positively, with nobody rating it negatively.

Discussion and Conclusions

Discussing the hypothesis about *Social Capital* first and zooming in on the component Relationship Characteristics, it is important to note that eTwinners believe AHTGs will help establish new contacts within the network. The observed network growth over time indicates that AHTGs support the creation of new connections, ensuring that connections are distributed across the participants. It means that weak and latent ties between eTwinners are explored, much as employing an intelligent matching mechanism to recruit people was hoped to achieve. This finding mirrors the results about recruiting latent and weak connections that were described by Haythornthwaite over a decade ago (2002). Participant views are mixed, though, as to whether AHTGs strengthen existing relationships: positive responses were collected via the questionnaire; half the interviewees, however, gave a neutral or negative response. Notwithstanding the fact that strengthening existing relationships would be conducive to increasing Social Capital, this finding is in line with our expectation: the matching mechanism used fa-

vours the creation of new links, so existing links are underrepresented in the selection the service makes of candidate AHTG participants.

With respect to the Sense of Connectedness, since the participants had already been active within the eTwinning core-user group - the eTwinning environment predated our experiment by several years - most of them should already have some. This is the likely reason for the inability to detect growth in this component previously (Fetter et al., 2012). However, when asking them about this explicitly, as was done in the present experiment, respondents express their believe that AHTGs foster a Sense of Connectedness amongst eTwinners.

Mutual Support is the use of connections within the network to gain (mutual) benefits (Fetter et al., 2010). AHTGs prove have a positive impact on Mutual Support. The usage-logs of the AHTGs service reveal a high level of participation. By and large, the results imply that AHTGs foster Social Capital by stimulating the creation and use of new relationships, and forums foster Social Capital through strengthening and using existing relationships.

Contrasting AHTGs with the forum, most participants felt they offered distinct functionalities. This was reflected in participants' intentional usage of a combination of both. This observation is undergirded by the view held by most participants that the use of AHTGs could reduce forum usage. Finally, these views do not reflect differences in usability. The usability of the AHTGs and the forum were both rated highly.

In summary, AHTGs do contribute to a network's Social Capital. They do so by recruiting weak and latent ties and turning them into strong ones. In contrast with our initial assumption that forums are unsuited to spark off the emergence and growth of long-lasting communities, the eTwinning participants seem to think differently about this. Our results suggest that a combination of both AHTGs and forums could provide a solid foundation for an emerging network and its underlying communities. Whilst AHTGs stimulate the creation of new ties by providing short-term support, forums provide a strengthening of existing ties and provide more in-depth support and discussion.

Some reservations with respect to our conclusions are in order. First, and at a quite specific level, the AHTG service was poorly integrated into the overall eTwinning platform, it was an add-on that needed the participants to take extra steps to access. Although they did not complain about usability, the lack of integration might have kept them away from using the AHTG service in the first place. One participant's remark about too many tools to use supports this idea. The relatively low number of questions asked - not even half of the participants asked one - might also be explained in this way. If the participation was low indeed, this could suggest a participation bias, favouring those who take an early-adopter stance (Rogers, 2003). After

all, it is they who are likely to try out something new. And this would mean that critical voices are underrepresented. Although this does not detract from the suitability of AHTGs, it would affect their adoption and hence decisions on their implementation.

Second, our conclusions are based on average user opinions and interview data were used in support of them. This led us to conclude that both AHTGs and forums strengthen social capital each in their own way: by creating new ties or reinforcing existing ones, respectively. Since we were primarily interested to establish the value of AHTGs as a novel social tool, our questions were not aimed at discovering differences in beliefs about either tool at the individual level. Specifically, does our conclusion by and large hold for each individual or are individuals as a collective split in half about their preferences for either tool? If that were the case, we would reach a similar conclusion at the overall level, but this time with marked individual differences in preferences. Such preferences, in turn, could be prompted by the kind of issue under discussion. That such an alternative interpretation makes sense is suggested by research by Mak and colleagues, who compared blogs with forums. It shows that learners do have personal preferences for either tool (Mak, Williams, & Mackness, 2010). Only a new questionnaire that gives equal attention to either tool can resolve this, is able to differentiate between both interpretations.

Finally and quite generally, we do not know anything about the long-term fate of the connections that are forged through AHTGs. Do they rapidly whither to become weak ties again, are they indeed a stepping stone towards more intense relationships? Presumably, both will occur, if only because one can maintain only so many strong ties (Hill & Dunbar, 2002). What exactly happens will likely depend on the prevailing circumstances (cf. Sutcliffe, Wang, & Dunbar, 2012) and not on the instrument through which a tie is strengthened, such as an AHTG or a forum, although such an effect cannot be excluded. Additionally, an interesting topic for future research would be the possible effect forums might have on AHTGs as well. As participants agreed AHTGs would have a positive influence on forums, the question now arises what the influence the other way around would be. Only an experiment that would monitor for a considerable period of time an entire network, could answer questions of long-term effects. Such an experiment would be interesting, as its results presumably would be generalizable to all kinds of networks.

Appendix: questions addressed in the structured interviews

1. Based on your experience with the AHTG service could you explain whether and in which way you think it can have a positive (or negative) effect on:
   a. Establishing new connections between eTwinners.
   b. Strengthening existing relationships between eTwinners.
   c. The benefits that can be obtained through interacting with other eTwinners
   d. Feeling part of the eTwinning network
   e. The intensity of interaction between eTwinners
   f. The continuous use of existing contacts.
2. Do you feel the AHTG and forum are significantly different from each other? Please explain your answer.
3. What do you think will be the effect of adding the AHTG to eTwinning with regard to the forum? What will the effect be on the forum and is this positive or negative? Please explain your answer.
4. Did you receive an email invitation from the AHTG service, inviting you to answer a question? If so, could please explain what your response was and why you choose that action?
5. How do you feel about the system the AHTG service used which automatically invited other eTwinners to answer a question? In addition, could you elaborate on what the biggest advantages and disadvantages are of these invitations?
6. Would you have any other comments regarding the use of the forum and/or the AHTG?

Chapter 7

Conclusions and Discussion

At the beginning of this thesis I introduced Boris the teacher and the online teacher network he was trying to be a part of. Both Boris and this so-called Learning Network experienced problems related to the establishment and maintenance of relationships between the Learning Network users. Boris was overwhelmed by the number of possibilities, users, and the high-level conversations going on in the communication environments. On the other hand, the Learning Network, as an entity, was struggling with many isolated users (users with no apparent relationships in the network), crowded communication environments, and a too high reliance on a small core group of users. Both the problems that Boris personally experienced and the problems at the level of the Learning Network (which are relevant for all users) as a whole exist in the eTwinning network (cf. Chapter 4). eTwinning is a network for schools in Europe (160.000+ users), which aims at bringing teachers and students together to do projects on various topics. In Chapter 4 we showed through the use of Social Network Analyses (SNA) that the majority of network users are either without any connections or are isolated in that they are separated from the core user group. Additionally, the eTwinners mentioned how difficult it was to find a user with a specific skillset. According to them it was one of the major challenges for eTwinning (Crawley, et al., 2009).

My main goal, as presented in this thesis, was to investigate whether the problems of both Boris and the shared user problems of the Learning Network as a whole (as present in eTwinning) could be solved by fostering the Social Capital on a personal (Boris) and network level (eTwinning). The notion of Social Capital focuses on relationships people have and the opportunities to use these relationships to one's advantage (Portes, 1998). Social Capital is about the relationships some person has and how these are used to gain access to the other's resources and contacts. Increasing Boris' Social Capital is also in the best interest of the network since, as described in Chapter 2, increasing the number of relationships between users make the network robust against changes in the network like drop-out. Furthermore, it has also been shown that an increase in Social Capital increases the willingness to speak, enhancing Boris' chance to start interacting (Sheehan, 2015). I focused on three Social Capital pillars, namely: (a) Relationship Characteristics - Relationships need to be established, (b) Sense of Connectedness – Relationships need to be maintained, and (c) Mutual Support – Relationships need to be capitalized on.

As discussed in Chapter 2, a good way of reinforcing Social Capital's pillars is through the use of peer-support (Fox & Wilson, 2015). To this end we used Ad Hoc Transient Groups (AHTGs). In AHTGs, 'tutors' (typically found using a matching system) and a 'tutee' work together in a small, closed-off, online space to solve some issue at hand (Berlanga, et al., 2008). Once a problem is resolved, the working space is typically available for ref-

erential purposes only. The ability of small peer-support groups like AHTGs to foster Social Capital has also been acknowledged by Anderson and Dron (2009). In their work Anderson and Dron (2009) state that the use of small focused groups can have a bonding effect with regard to Social Capital. From an innovation and co-creation (as in peer-support) point of view Social Capital and co-creation go hand in hand as well. As stated by Ehlen, van der Klink, and Boshuizen (2014, pp. 32-33):

> *"Social capital theory offers a holistic framework for the dynamic and complex process of co-creation. By doing so, it emphasizes the role of the actors/professionals as co-creators in innovation, and clarifies the necessary conditions in structure, relations, cognition and actions for the co-creation of new value."*

AHTGs and Social Capital

Relationship Characteristics

One of the described problems for the Learning Network was a high dependency on a small core group of users, while most other users remained isolated. ETwinning, the Learning Network we tested in, was indeed very dependent on a core, well-interconnected, group of users (cf. Chapter 4). Interestingly, at the eTwinning conference, where the stakeholder's analyses were carried out (cf. Chapter 3), it became apparent that this core group could be seen as a network in itself. This becomes even more apparent when looking at the SNA results of Chapter 4. In essence, there are two eTwinnings. One consists of a couple of thousand highly connected users and the other consists of over 100.000 mainly unconnected users. So even though the core group was stable in itself, the problem remained that most eTwinners were hardly to not at all connected to others. The introduction of AHTGs, our research suggests, would be very useful to interconnect these two subnetworks. AHTGs would be able to bridge the gap between the two eTwinnings and transform the network into one. AHTGs achieve this by promoting network growth in a decentralized way, expanding the core network thus ensuring that the ensuing larger network is less reliant on the core users alone. In addition, the low threshold for participants to ask and answer a question heightens the chance for participants to engage in some activity. This is especially important in the beginning, for new participants as the longer users remain inactive, the lower their chance to ever start participating (Neelen & Fetter, 2010; Sun, Rau, & Ma, 2014).

Sense of Connectedness

Another Social Capital aspect introduced in Chapter 1 is the sense of be-longing to the community: the sense of connectedness. A high sense of con-nectedness is important to avoid that people feel alone (Rovai, 2002), to increase their motivation (Poellhuber, Chomienne, & Karsenti, 2008), and to prevent drop-out (McInnerney & Roberts, 2004). As established already in 1998 by Wegerif (1998), this makes a lot of sense in theory. However, the practice of our situation was that the core users already felt highly connect-ed to begin with and the 'fringe users' could hardly be contacted at all (see below for more on this). Thus, the problem became that no intervention was likely to change significantly the already established feeling of connected-ness of the core users; and where progress was potentially to be made, with the fringe users, no intervention could be applied as they remained out of reach. So, not only were there no differences between control and interven-tion groups, indeed and quite unexpectedly, the sense of connectedness decreased for all groups, even for the no-intervention group. So, clearly other factors were of influence. As we were able to reach core users only, this decrease is difficult to interpret as we do not know what happened to the unconnected eTwinners' sense of connectedness. Taken together, we cannot but conclude that our results are inconclusive when it comes to the influence of AHTGs on the sense of connectedness for the whole network (not just the core users), making future research necessary.

Mutual Support

Mutual support refers to the actions which positively influence social capi-tal (Lesser, et al., 2000), the actual usage of the established connections. First, mutual support becomes an informal type of currency. For example, being helped can be powerful incentive for giving help in return, or to some-one else, resulting in trade for services so to speak. Second, combined ef-forts result in a more positive view on the community as a whole, especially when subjects are closely linked. And finally, to retain social capital, it needs to be maintained, by re-establishing, sustaining, and creating rela-tionships between participants (Griffin & Griffin, 1998; Gyongyi, et al., 2007).

The results as reported on in Chapter 5 showed that, when compared to the Forum group, participants using AHTGs did not only ask more ques-tions, but also that more participants asked at least one question. For com-parison, many questions were also asked in the Forum group, yet by a handful of participants only. This finding is crucial for AHTGs as it shows that they enable participants to easily ask a question and, more important-ly, have more participants join in. This is important, as once inactive partic-

ipants become active, they tend to stay active (Neelen & Fetter, 2010). Furthermore, the result that more questions are asked by more individuals is a clear sign of a lower threshold to engage and connect.

AHTGs and matchmaking

For Boris, one of the problems was to find the right person. This is a serious problem in a network like eTwinning where there are so many users. Therefore, we used a matching system to find appropriate users. Such a system would have brought Boris in contact with other teachers without him having to do anything but ask a question. In other words, the use of Ad Hoc Transient Groups would have provided Boris with a way to ask his questions while at the same time establishing his first relationships within the network. This could help teachers like Boris to overcome the initial sense of isolation as is common in networked communication environments (Fazeli, Brouns, Drachsler, & Sloep, 2012).

While clearly worth using, a matching algorithm is very network dependent. It relies heavily on the available user data and the interpretation of it. Even if one would use a matching system based solely on availability one needs to keep track of the data. And while Van Rosmalen (2008a) has shown that such a matching works, their work and ours clearly show that matching on more specific data does give a better result. Our result thus supports the initial results as reported by Van Rosmalen, et al. (2008b). In their work, Van Rosmalen, et al. (2006) compared the use of no-matching, with matching based on availability, and matching using additional Latent Semantic Analyses (LSA). While beneficial in many cases, LSA was no option within the eTwinning network. The reason for this was that a large text corpus is needed for LSA to work (Van Rosmalen, et al., 2007). However, the eTwinning network provided no meaningful, large-enough corpus to work with.

The benefits and challenges of a user-centric design

With regard to matchmaking and other design considerations, it was important to include the wishes and opinions of the actual stakeholders, i.e. the eTwinners. To this end the initial design was presented at an eTwinning Conference followed by an in-depth discussion (cf. Chapter 3). This is in line with the user-centered design approach as described by (Parmar, 2009). It operates on the assumption that ICT tools such as the present one should be developed together with stakeholders in order to arrive at a user-defined service that fulfills the stakeholders' actual needs.

Mutual support

The most important result from this stakeholder's analysis was the removal of user ratings within AHTGs. One part of the theoretically important requirements for mutual support is that participants need to be accountable for their actions and thus have a surrounding which would stimulate an iterated tit-for-tat strategy (Axelrod, 2006). The plan was to include request fulfillment ratings, which participants had to provide after each question was answered (or closed without an answer). Furthermore, for tit-for-tat strategies to work it is also important that (1) participants need to be recognizable, (2) there is a sizeable likelihood they will meet again in the future, (3) the possibility to help in the future should be limited, and (4) possible future interactions should not decrease in importance fast (Sloep, 2009a). As Sloep (2009a) points out, these aspects can be fulfilled by AHTGs. However, in the eTwinning case the ratings, and thus to some extent the accountability, did not make it into the final prototype. The eTwinners made it very clear that they did not want to rate their peers in any way. It was literally stated by eTwinners at the workshop that they would not use the tool if the ratings would be included. This example shows just how important it is to have a stakeholder's analysis before actually starting prototype development. The removal of the ratings improved the likelihood of adoption. This does however bring up some important implications for using ratings in peer-support. As ratings are very common on the web, it is easy to see how a Learning Network would also include these as an extra incentive in order to stimulate the use of the AHTGs peer-support environment. In our case, however, using ratings would likely have had a negative effect.

Matching

Another result of adopting the user-centric approach was the addition of the possibility for participants to choose peers from a list generated by the matching system (cf. Chapter 3). This addition was probably the reason for the unexpected result that AHTGs were primarily seen as strengthening existing relationships rather than fostering new ones. This conclusion seems even more likely when considering the results of the second experiment where this choice was removed and the results showed no signs anymore of AHTGs strengthening existing relationships. In this case the reliance on the user-centric approach backfired as the added idea was detrimental to the experiment.

Even though one addition that resulted from the stakeholder's analyses was not positive, other insights gained (especially the removal of the ratings) improved our prototype and experimental setup. In conclusion, it remains

vital to showcase a service to its intended audience, yet one should exercise restraint in adding new features.

Challenges

Going back to Boris, in spite of AHTGs being available for use, Boris might still never end up actually using them. The reason for this is that there could still be so many other communication environments that it is uncertain whether Boris would indeed encounter them. Indeed, adding the AHTGs environment actually makes this problem of too many communication means to choose from even worse. This problem is not a contrived one: as became evident in our second experiment some of the less enthusiastic interviewees pointed out that the eTwinning network already had too many different types of communication options. In the case of eTwinning, introducing AHTGs would imply the need to monitor very carefully the existing communication channels. In all likelihood, rather than introducing yet another tool, it might be better to replace an existing one by AHTGs or alter an existing one to accommodate AHTGs.

Another challenge refers to what may be described as network restrictiveness. In order to have the highest chance of reaching new and /or isolated eTwinners, the most direct route would have been sending all eTwinners an invitational email. However, this was not allowed as it is a standing eTwinning policy to keep bulk emails to an absolute minimum. While understandable, this restriction meant I had to use the eTwinning newsletter and the eTwinning dashboard. Unfortunately, these communication environments target the already connected (core) user and not so much the new or the isolated user. Thus, the aim to connect isolated users was difficult to accomplish. This realization points to an important lesson network providers should take at heart: If you want to get more isolated / inactive users involved, you need to approach them directly. Any other method will likely not pay off as they will not be aware of your efforts. Additionally, one may wonder whether network providers should not make a clear choice for a particular communication environment to which new users are sent immediately after registration. Do not let new users wander around in your network, take them through the beginning step-by-step, and do anything possible to get them connected to others immediately. Take, for example, the professional network LinkedIn (Linkedin.com). While this network has many opportunities and choices, it uses an elaborate step-by-step approach that makes it easy to get started. At the same time, this step-by-step approach also makes sure LinkedIn has enough data to work with and feed interesting data back to the user, heightening the incentive to participate immediately.

As indicated, due to the policy restrictions, I mainly reached core users. However, I still ended up with 375 participants who were fit for analysis. In that respect, one important challenge which arose during the setup of the experiment was the limited choice in Social Network Analyses (SNA) available for my purposes. To clarify, most SNA assume a fully connected network, with no stray individuals. This means that isolates cannot be included in the analyses. Yet in our case, excluding isolates would have given a warped image of reality. Furthermore, from a top-down, online-network perspective, it is important to perceive isolated participants as still part of the network (Malinen, 2015). Take for instance the concept of lurking. A lurker might not have any strong, mutual relationships within the network, but might still actively read posts and use these in other surroundings (Neelen & Fetter, 2010; Preece, Nonneke, & Andrews, 2004; Sun, et al., 2014). Imagine having a blogging network without lurkers, there would hardly be any point in writing a blog in the first place. However, taking isolates into account did mean that standard SNA parameters like Freeman's Betweenness were unusable. This was the reason for using a combination of different SNA approaches in order to still be able to draw well-founded conclusions about the network structure. Since this type of situation, a sparsely connected network with a large number of isolates, is likely to be found more often in educational contexts (see also (Fazeli, et al., 2012), the following suggestions are in order as each question answered with yes will reduce the number of meaningful SNAs for the researcher:

a) Do isolates need to be included in the analyses?
b) Is the strength of the relationships important?
c) Do the directions of the relationships matter?
d) Is the network very large?

Results and Future Research

Taken together, the results of both experiments reported in Chapters 5 and 6 clearly indicate that AHTGs do foster Social Capital through improving Relationship Characteristics as well as stimulating Mutual Support. The Sense of Connectedness hypothesis remains unconfirmed, although the experiment of Chapter 6 showed participants to believe AHTGs will have a positive effect. That experiment also puts the results of the earlier experiment (cf. Chapter 5) in a different perspective. While AHTGs in general have the sought-after effect, the later experiment has shown that AHTGs might not be useful in all situations. It is this combination of a more quantitative and a more qualitative experiment which improved our understanding of the data of both experiments. As Barbour (2001) states, using mixed methods can really help us in comprehending results and allows a more reflective analysis of the data.

With regard to eTwinning - and by extension to any network which is large and sparse with a small, well-connected core - it would be well worth investigating what a full integration of AHTGs into the network would bring about, preferably making them available to novel users already. The positive influence AHTGs appear to have on Social Capital as well as the appreciation of using AHTGs eTwinners showed, give a strong basis for such an implementation. Alternatively, one could focus on the large group of isolated eTwinners through using an experimental setup using AHTGs. However, such an experiment would mean that eTwinning has to change policies and actively approach new and unconnected users.

At this juncture one may consider the implementation of AHTGs in educational settings more broadly. I chose to focus on Social Capital as a key concept, not so much on the actual learning that supposedly took place. By choosing this perspective the results obtained are applicable to any online network which strives to be a decentralized network with few isolates and much mutual support. To the extent that AHTGs do indeed foster Social Capital, they are not only a beneficial addition to Learning Networks, but should be considered by all online networks as a viable addition to their communication environments. What is also clear from the results is that AHTGs work well in an open setting. In previous work, AHTGs were typically closed to anyone except those expressly invited (Sloep, 2009a). However, as shown in Chapter 6, opening up the AHTGs to the public seemed to have positive effects only. For completeness sake, it should be noted that such an approach has been attempted with the so-called social search engine Aardvark (Horowitz & Kamvar, 2012) (see below for more details).

Where should research in AHTGs go next? More research is needed along multiple pathways. Directly related to our own results is the question what kind of effect AHTGs exactly have on the Sense of Connectedness. While some indications for positive effects were found these were far from conclusive. A laboratory experiment may be advisable to investigate the sense of connectedness. For example, one may expose three groups of unrelated participants to either AHTGs, a forum, or both and measure their sense of connectedness before and after the exposition. Alternatively, one could introduce AHTGs to an existing but small network, one where interactions are clear cut and the AHTGs can be directly integrated into the actual Network, without any other changes being made.

Secondly, one aspect of Social Capital omitted in the present study is trust. Trust is an important aspect of online learning networks (Chopra & Wallace, 2003; Rusman, 2011). It therefore makes a lot of sense to study whether and how trust develops in and as a consequence of the use of AHTGs.

Thirdly, it is time for AHTGs to scale up. One instance where this was successfully tried was, again, Aardvark (Horowitz & Kamvar, 2012). Aard-

vark was a social search engine through which people could ask questions and a matching system would invite others to answer. What Aardvark did very well was the matching and question answering. What was missing however, was a real surrounding community, making it very difficult for actual relationships to be established. Still, Aardvark was a successful proof of concept for AHTGs and was bought up by Google in 2010.

Another, current example is ResearchGate (http://www.research-gate.net/). In this social network for scientists, AHTGs are used to let some member ask questions to scientific peers. Their approach comes close to how I see AHTGs used. However the one aspect missing is the transience. In ResearchGate, discussions and questions stay open for ever. From an academic point of view this makes sense as a discussion does often not reach closure within one week. However, for other networks implementing AHTGs, it might turn out to be more important to ensure questions also disappear from view. The reason for this is that for many getting an answer is not the sole perhaps not even the main reason for asking a question. Asking a question is rather a means for making social contact as is in line with the Mutual Support pillar of Social Capital. To take eTwinning as an example, most questions' answers asked could also have been found on the eTwinning website. Parenthetically, note that keeping such answers publically available would undermine the need to ask such questions and could thus hamper the creation of new connections.

The fourth future research pathway could explore to what extent AHTGs can coexist with other communication environments. As our results show that AHTGs might have a positive influence on the forum use and they might be beneficial to each other, it would be very interesting to see how this combination would work out and how other combinations of communication methods would interact.

The fifth and final future research pathway explores what kind of content is best handled in AHTGs. While I focused on questions, earlier work (Weber, 2004) already stated that episodic communities (which are similar to AHTGs) could potentially be used for a variety of contents, like, for example, doing a short project together.

So there is still much to research on AHTGs. Hopefully, this thesis combined with the earlier work on AHTGs, has now built a strong foundation for such endeavors.

References

Anderson, B. (2004). Dimensions of learning and support in an online community. *Open Learning, 19*(2), 183-190.

Anderson, T., & Dron, J. (2009). How the Crowd Can Teach. In H. Stylianos & W. Steven (Eds.), (Vol. Handbook of Research on Social Software and Developing Community Ontologies, pp. 1-17): Information Science Reference.

Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities. Retrieved from http://www.oerderves.org

Axelrod, R. (2006). *The Evolution of Cooperation - Revised Edition.* New York: Basic Books.

Barbour, R. S. (2001). Checklists for improving rigour in qualitative research: a case of the tail wagging the dog? *British Medical Journal, 322*, 1115-1117.

Berlanga, A. J., Kalz, M., Stoyanov, S., Van Rosmalen, P., Smithies, A., & Braidman, I., et al. (2009, July, 14-18, 2009). *Using Language Technologies to Diagnose Learner's Conceptual Development.* Paper presented at the 9th IEEE International Conference on Advanced Learning Technologies (ICALT2009), Riga, Latvia.

Berlanga, A. J., Sloep, P., Brouns, F., Van Rosmalen, P., Bitter-Rijpkema, M. E., & Koper, R. (2007). *Functionality for learning networks: lessons learned from social web applications.* Paper presented at the E-portfolio 2007, Maastricht, Netherlands. http://hdl.handle.net/1820/1011

Berlanga, A. J., Sloep, P. B., Kester, L., Brouns, F., Van Rosmalen, P., & Koper, R. (2008). Ad hoc transient communities: Towards fostering knowledge sharing in learning networks. *International Journal of Learning Technology, 3*(4), 443-458. doi: 10.1504/IJLT.2008.019378

Billett, S. (2010). The perils of confusing lifelong learning with lifelong education. *International Journal of Lifelong Education, 29*(4), 401-413.

Boomen, M. v. d. (2008). *From Community Metaphor to Web 2.0.* Paper presented at the IADIS International Conference on Web Based Communities (WEBC 2008), Amsterdam, The Netherlands: IADIS press.

Brouns, F., Bitter-Rijpkema, M., Sloep, P. B., Kester, L., Van Rosmalen, P.,

Berlanga, A., et al. (2007). *Personal profiling to stimulate participation in learning networks.* Paper presented at the ePortfolio 2007 Conference. October, 18-19, 2007, Maastricht, The Netherlands.

Brouns, F., Fetter, S., & Van Rosmalen, P. (2009). How to trigger emergence and self-organisation in Learning Networks. In R. Koper (Ed.), *Learning Network Services for Professional Development* (pp. 52 - 72). Berlin, Germany: Springer Verlag.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Brown, J. S., & Duguid, P. (2000). *The social life of information.* Boston Mass: Harvard Business School University Press.

Burt, R. S. (2005). *Brokerage and Closure: An Introduction to Social Capital*: Oxford University Press Inc., New York.

Castells, M. (1996). *The information age: economy, society and culture, part 1: the rise of the network society.* Oxford, UK: Blackwell.

Caswell, T., Henson, S., Jensen, M., & Wiley, D. (2008). Open Educational Resources: Enabling Universal Education. *Online Submission.*

Chang, B., Cheng, N.-H., Deng, Y.-C., & Chan, T.-W. (2007). Environmental design for a structured network learning society. *Computers & Education, 48*(2), 234-249.

Cho, H., Gay, G., Davidson, B., & Ingraffea, A. (2007). Social networks, communication styles, and learning performance in a CSCL community. *Computers & Education, 49*(2), 309-329.

Chopra, K., & Wallace, W. A. (2003). *Trust in Electronic Environments.* Paper presented at the International Conference on System Sciences, Hawaii.

Colardyn, D. (2001). From Formal Education And Training to Lifelong Learning: What is New? Will it Work Better? In D. Colardyn (Ed.), *Lifelong Learning: Which Ways Forward?* Retrieved (11-05-2011) from http://www.cedefop.europa.eu/EN/publications/13310.aspx.

Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology, 94*(s1), S95. doi: doi:10.1086/228943

Coleman, J. S. (1990). *Foundations of Social Theory*: Harvard University Press, UK.

Crawley, C., Gilleran, A., Scimeca, S., Vuorikari, R., & Wastiau., P. (2009). Beyond School Projects – a report on eTwinning 2008-2009. Central Support Service for eTwinning. Retrieved from http://www.etwinning.net/en/pub/discover/publications.htm

Cronin, G. (2001). eXtreme Solo: A Case Study in Single Developer eXtreme Programming. 68. Retrieved from http://www.croninsolutions.com/writing/eXtremeSolo.pdf

Cross, R., & Parker, A. (2004). The Hidden Power of Social Networks *The Hidden Power of Social Networks: Understanding How Work Really Gets Done in Organization.* Boston: Harvard Business School Publishing Corporation.

Crowder, R., Hughes, G., & Hall, W. (2003). *An agent based approach to finding expertise in the engineering design environment.* Paper presented at the 14th International Conference on Engineering Design, Stockholm.

Davis, H. C., Carr, L., Hey, J. M. N., Howard, Y., Millard, D., Morris, D., et al. (2010). Bootstrapping a Culture of Sharing to Facilitate Open Educational Resources. *IEEE Transactions on Learning Technologies, 3*(2), 96 - 109.

Dawson, S. (2006). A study of the relationship between student communication interaction and sense of community. *Internet and Higher Education, 9*, 153–162.

De Bakker, G. (2010). *Allocated online reciprocal peer support via instant messaging as a candidate for decreasing the tutoring load of teachers (Doctoral dissertation).* Eindhoven University (ESoE), Eindhoven, The Netherlands. Retrieved from http://alexandria.tue.nl/extra2/685255.pdf

De Bakker, G., Sloep, P. B., & Jochems, W. (2008). *Towards a system for allocated peer tutoring via instant messaging.* Paper presented at the ALTC-Conference, Leeds, UK.

De Choudhury, M., Sundaram, H., John, A., & Seligmann, D. (2008). *Dynamic prediction of communication flow using social context.* Paper presented at the Nineteenth ACM Conference on Hypertext and Hypermedia – HT '08, p.49.

DeSanctis, G., Fayard, A.-L., Roach, M., & Jiang, L. (2003). Learning in Online Forums. *European Management Journal, 21*(5), 565-577.

Downes, S. (2007). Models for Sustainable Open Educational Resources. *Interdisciplinary Journal of Knowledge and Learning Objects, 3*, 29-44.

Drachsler, H., Hummel, H., & Koper, R. (2009). Identifying the Goal, User model and Conditions of Recommender Systems for Formal and Informal Learning. *Journal of Digital Information, 10*(2), 4-24. doi: http://hdl.handle.net/1820/1187

Dron, J., & Anderson, T. (2014). *Teaching Crowds; Learning and Social Media.* Athabasca, Canada: AU Press, Athabasca University.

Eggens, L., Werf, M. P. C. V. d., & Bosker, R. J. (2008). The influence of personal networks and social support on study attainment of students in university education. *Higher Education, 55*, 553–573.

Ehlen, C., van der Klink, M., & Boshuizen, H. (2014). One Hundred Years of 'Social Capital': Historical Development and Contribution to Collective Knowledge Creation in Organizational Innovation. *Submitted*, 32-33.

Ehrlich, K., Lin, C.-Y., & Griffiths-Fisher, V. (2007). *Searching for experts in the enterprise: combining text and social network analysis.* Paper presented at the Proceedings of the 2007 international ACM conference on Supporting group work, Sanibel Island, Florida, USA.

Eraut, M. (2004). Informal learning in the workplace. *Studies in Continuing Education, 26*(2), 247-273.

Erickson, T., & Kellogg, W. A. (2000). Social translucence: an approach to designing systems that support social processes. *ACM Transactions on Computer-Human Interaction, 7*(1), 59-83. doi: 10.1145/344949.345004

Eun, B., Knotek, S., & Heining-Boynton, A. (2008). Reconceptualizing the Zone of Proximal Development: The Importance of the Third Voice. *Educational Psychology Review, 20*(2), 133-147.

European_Commission. (2000). Commission Staff Working Paper. A Memorandum on Lifelong Learning. SEC(2000) Retrieved (11-05-2011), from http://ec.europa.eu/education/index_en.htm

European_Commission. (2006). Commission staff working document; progress towards the Lisbon objectives in education and training. Report based on indicators and benchmarks. SEC(2006) Retrieved (11-05-2011), from http://ec.europa.eu/education/policies/2010/doc/progressreport06.pdf

European_Commission. (2009). The Governance Challenge for Knowledge Policies in the Lisbon Strategy: Between revolution and illusion. Synthesis Report of Expert Group for the follow-up of the research aspects of the revised Lisbon Strategy Retrieved (11-05-2011), from doi:10.2777/60302

European_Schoolnet. (2010). Tellnet project –Teachers' Lifelong Learning Network 2010 Retrieved 24-11, 2013, from http://www.tellnet.eun.org/tellnet.

Fazeli, S., Brouns, F., Drachsler, H., & Sloep, P. B. (2012). *Exploring social recommenders for teacher networks to address challenges of starting teachers.* Paper presented at the Eighth International Conference on Networked Learning 2012.

Fetter, S., Berlanga, A. J., & Sloep, P. B. (2008). *Strengthening the Community in Order to Enhance Learning.* Paper presented at the Doctoral Consortium at the IADIS International Conference on Web Based Communities (WEBC 2008), Amsterdam, The Netherlands: IADIS press.

Fetter, S., Berlanga, A. J., & Sloep, P. B. (2009). Designing an Ad Hoc Transient Communities Service in Order to Enhance the Social Capital of Learning Communities. In M. Spaniol, Q. Li, R. Klamma & R. W. H. Lau (Eds.), *8th International Conference on Web-based Learning (ICWL)* (pp. 150-157). Aachen, Germany: Springer.

Fetter, S., Berlanga, A. J., & Sloep, P. B. (2010a). Fostering Social Capital in a Learning Network: Laying the Groundwork for a Peer-Support Service. *International Journal of Learning Technology, 5*(4), 388 - 400. doi: 10.1504/IJLT.2010.038774

Fetter, S., Berlanga, A. J., & Sloep, P. B. (2010b). *Using Ad Hoc Transient Communities to Strengthen Social Capital: Design Considerations.* Paper presented at the 7th International Conference on Networked Learning, Aalborg, Denmark.

Fetter, S., Berlanga, A. J., & Sloep, P. B. (2012a). Peer-support and Open Educational Resources. In A. Okada, T. Connolly & P. J. Scott (Eds.), *Collaborative Learning 2.0 - Open Educational Resources* (pp. 253-271). Hershey, PA: IGI Global.

Fetter, S., Berlanga, A. J., Sloep, P. B., Vegt, W. v. d., Rajagopal, K., & Brouns, F. (2012b). Using Peer-Support to Connect Learning Network Participants to Each Other: An Interdisciplinary Approach. *International Journal of Learning Technology, 7*(4), 378-399. doi: 10.1504/IJLT.2012.052212

Fetter, S., Berlanga, A. J., Sloep, P. B., & Vuorikari, R. (2011). Major trends arising from the network - Deliverable 3.1: Tellnet project

Fetter, S., Vegt, W. v. d., & Sloep, P. B. (2015). Fostering Online Social Capital through Peer-Support. *International Journal on Webbased Communities, 11*(3).

Fiedler, S., & Pata, K. (2007). Towards an environment design model for iCamp space (D1.2). Retrieved from http://www.icamp.eu

Fox, A. R. C., & Wilson, E. G. (2015). Networking and the development of professionals: Beginning teachers building social capital. *Teaching and Teacher Education, 47*, 93-107. doi: http://dx.doi.org/10.1016/j.tate.2014.12.004

Freeman, L. C. (1978). Centrality in social networks conceptual clarification. *Social Networks, 1*(3), 215-239. doi: 10.1016/0378-8733(78)90021-7

Gleitman, H., Fridlund, A. J., & Reisberg, D. (1998). *Psychology.* New York, NY: W.W. Norton.

Granovetter, M. S. (1973). The Strength of Weak Ties. *American Journal of Sociology, 78*(6), 1360-1380.

Greer, J. E., McCalla, G. I., Collins, J., Kumar, V., Meagher, P., & Vassileva, J. (1998). Supporting peer help and collaboration in distributed workplace environments. *International Journal of Artificial Intelligence in Education*(9), 159–177.

Griffin, M. M., & Griffin, B. W. (1998). An Investigation of the Effects of Reciprocal Peer Tutoring on Achievement, Self-Efficacy, and Test Anxiety. *Contemporary Educational Psychology, 23*(3), 298-311.

Gyongyi, Z., Koutrika, G., Pedersen, J., & Garcia-Molina, H. (2007). Questioning Yahoo! Answers: Stanford InfoLab

Haythornthwaite, C. (2002). Strong, Weak, and Latent Ties and the Impact of New Media. *The Information Society, 18*(5), 385-401.

Hill, R. A., & Dunbar, R. I. M. (2002). Social network size in humans. *Human Nature, 14*(1), 53-72.

Horowitz, D., & Kamvar, S. D. (2010). *The Anatomy of a Large-Scale Social Search Engine.* Paper presented at the WWW2010, April 26-30, 2010, Raleigh, North Carolina, Raleigh, North Carolina.

Horowitz, D., & Kamvar, S. D. (2012). Searching the Village: Models and Methods for Social Search. *Communications of the ACM, 55*(4), 111-118. doi: 10.1145/2133806.2133830

Hsiao, Y. P., Brouns, F., Kester, L., & Sloep, P. B. (2009, November, 20-22, 2009). *Optimizing Knowledge Sharing In Learning Networks Through Peer Tutoring.* Paper presented at the IADIS International Conference Cognition and Exploratory Learning in Digital Age (CELDA 2009), Rome, Italy: Springer.

Huang, J., Brink, H. M. v. d., & Groot, W. (2008). A meta-analysis of the effect of education on social capital. *Economics of Education Review, In Press, Accepted Manuscript.*

Hughey, J., Speer, P. W., & Peterson, N. A. (1999). Sense of community in community organizations: Structure and evidence of validity. *Journal of Community Psychology, 27*(1), 97-113.

Johnson, M. (2008, 5-6 May). *Expanding the concept of networked learning.* Paper presented at the Sixth International Conference on Networked Learning, Halkidiki, Greece.

Jones, C., & Czerniewicz, L. (2011). Theory in learning technology. *Research in Learning Technology, 19*(3), 173-177. doi: 10.1080/21567069.2011.632491

Kavanaugh, A., Reese, D. D., Carroll, J. M., & Rosson, M. B. (2003). *Weak Ties in Networked Communities.* Paper presented at the First International Conference on Communities and Technologies, C&T 2003, Amsterdam, The Netherlands.

Kester, L., Sloep, P. B., Van Rosmalen, P., Brouns, F., Koné, M., & Koper, R. (2007). Facilitating community building in Learning Networks through peer tutoring in ad hoc transient communities. *International Journal on Webbased Communities, 3*(2), 198-205.

Kester, L., Van Rosmalen, P., Sloep, P. B., Brouns, F., Brouwers, M., & Koper, R. (2006). *Matchmaking in Learning Networks: A System to Support Knowledge Sharing.* Paper presented at the International Workshop in Learning Networks for Lifelong Competence Development, March, 30-31, 2006, Sofia, Bulgaria: TENCompetence Conf.

Koper, R., & Tattersall, C. (2004). New Directions for Lifelong Learning Using Network Technologies. *British Journal of Educational Technology, 35*(6), 689-700.

Kozinets, R. V. (1999). E-tribalized marketing?: The strategic implications of virtual communities of consumption. *European Management Journal, 17*(3), 252-264. doi: 10.1016/S0263-2373(99)00004-3

Krebs, V., & Holley, J. (2006). Building Smart Communities through Network Weaving. Retrieved from http://www.orgnet.com/BuildingNetworks.pdf

Landauer, T. K., Foltz, P. W., & Laham, D. (1998). An Introduction to Latent Semantic Analysis. *Discourse Processes, 25*, 259-284.

Lane, A. (2008). Widening Participation in Education through Open Educational Resources. In T. Iiyoshi & M. S. V. Kumar (Eds.), *Opening Up Education: The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge* (pp. 149 - 163). London, UK: The MIT Press.

Lane, A., McAndrew, P., & Santos, A. (2009). *The networking effects of OER.* Paper presented at the 23rd ICDE World Conference 2009, Maastricht, The Netherlands.

Laurillard, D. (2012). Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology. Routledge, New York and London.

Lazar, J., & Preece, J. (2002). Social Considerations in Online Communities: Usability, Sociability, and Success Factors. In H. v. Oostendorp (Ed.), *Cognition in the Digital World* (pp. 127-152). Mahwah: NJ.: Lawrence Erlbaum Associates Inc. Publishers.

Lee, S. D. (2008). The Gates Are Shut: Technical and Cultural Barriers to Open Education. In T. Iiyoshi & M. S. V. Kumar (Eds.), *Opening Up Education: The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge* (pp. 47 - 59). London, UK: The MIT Press.

Lesser, E. L., Fontaine, M. A., & Slusher, J. A. (2000). Communities of Practice, Social Capital and Organizational Knowledge *Knowledge and Communities* (pp. 123-132): Butterworth-Heinemann.

Lin, C., Ehrlich, K., Griffiths-Fisher, V., & Desforges, C. (2008). SmallBlue: People Mining for Expertise Search. *IEEE MultiMedia*, 78-84.

Littlejohn, A. (Ed.). (2003). *Reusing online resources: A sustainable approach to e-learning.* London: Kogan Page.

Littlejohn, A., Milligan, C., & Margaryan, A. (2012). Charting collective knowledge: Supporting self-regulated learningmin the workplace. *Journal of Workplace Learning, 24*(3), 226-238. doi: 10.1108/13665621211209285

Long, B., & Baecker, R. (1997). *A Taxonomy of Internet Communication Tools.* Paper presented at the WebNet'97, AACE.

Ma, W. W. K., & Yuen, A. H. K. (2011). Understanding online knowledge sharing: An interpersonal relationship perspective. *Computers & Education, 56*(1), 210-219.

Mak, S., Williams, R., & Mackness, J. (2010). *Blogs and forums as communication and learning tools in a MOOC.* Paper presented at the 7th International Conference on Networked Learning.

Malinen, S. (2015). Understanding user participation in online communities: A systematic literature review of empirical studies. *Computers in Human Behavior, 46*, 228-238. doi: http://dx.doi.org/10.1016/j.chb.2015.01.004

Margaryan, A., & Littlejohn, A. (2007). Repositories and communities at cross-purposes: issues in sharing and reuse of digital learning resources. *Journal of Computer Assisted Learning, 24*(4), 333-347. doi: 10.1111/j.1365-2729.2007.00267

McCalla, G. I., Greer, J. E., Kumar, V. S., Meagher, P., Collins, J. A., Tkatchy, R., et al. (1997). *A Peer Help System for Workplace Training.* Paper presented at the AIED97.

McDonald, J. (2007). *The Role of Online Discussion Forums in Supporting Learning in Higher Education.* University of Southern Queensland.

McGrath, J. E., Arrow, H., & Berdahl, J. L. (2000). The Study of Groups: Past, Present, and Future. *Personality & Social Psychology Review (Lawrence Erlbaum Associates), 4*(1), 95-105.

McGreal, R. (2004). *Online Education Using Learning Objects.* London, New York: Routledge Falmer.

McInnerney, J. M., & Roberts, T. S. (2004). Online Learning: Social Interaction and the Creation of a Sense of Community. *Educational Technology & Society, 7*(3), 73-81.

Meyerson, D., Weick, K. E., & Kramer, R. M. (1996). Swift Trust and Temporary Groups. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: Frontiers of Theory and Research.* London: SAGE Publications.

Molenaar, N. M. (2010). *Ties with Potential.* University of Amsterdam, Amsterdam. Retrieved from Retrieved from http://dare.uva.nl/record/339484 (978-90-9025362-6)

Nardi, B. A., Whittaker, S., & Schwarz, H. (2000). It's not what you know, it's who you know: work in the information age. *First Monday, 5*(5). Retrieved from http://www.firstmonday.org/issues/issue5_5/nardi/index.html

Neelen, M., & Fetter, S. (2010). Lurking: a challenge or a fruitful strategy? A comparison between lurkers and active participants in an online corporate community of practice. *International Journal of Knowledge and Learning, 6*(4), 269 - 284.

Newman, M. E. J. (2005). A measure of betweenness centrality based on random walks. *Social Networks, 27*(1), 39-54. doi: 10.1016/j.socnet.2004.11.009

Parmar, V. (2009). A Multidisciplinary Approach to ICT Development. [Article]. *Information Technologies & International Development, 5*(4), 89-96.

Pham, M., Cao, Y., Klamma, R., & Jarke, M. (2011). A Clustering Approach for Collaborative Filtering Recommendation Using Social Network Analysis. *Journal of Universal Computer Science, 17*(4), 583--604.

Poellhuber, B., Chomienne, M., & Karsenti, T. (2008). The Effect of Peer Collaboration and Collaborative Learning on Self-Efficacy and Persistence in a Learner-Paced Continuous Intake Model. *Journal of Distance Education, 22*(3), 41-62.

Poole, M. S., Hollingshead, A. B., McGrath, J. E., Moreland, R. L., & Rohrbaugh, J. (2004). Interdisciplinary Perspectives on Small Groups. *Small Group Research, 35*(1), 3-16. doi: 10.1177/1046496403259753

Pooley, J. A., Cohen, L., & Pike, L. T. (2005). Can sense of community inform social capital? *The Social Science Journal, 42*, 71–79.

Portes, A. (1998). SOCIAL CAPITAL: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology, 24*(1), 1. doi: 10.1146/annurev.soc.24.1.1

Prasad, M. K., Udupa, K., Kishore, K. R., Thirthalli, J., Sathyaprabha, T. N., & Gangadhar, B. N. (2009). Inter-rater reliability of Hamilton depression rating scale using video-recorded interviews - focus on rater-blinding. *Indian Journal of Psychiatry, 51*(3), 191-194.

Preece, J., Nonneke, B., & Andrews, D. (2004). The top five reasons for lurking: Improving community experiences for everyone. *Computers in Human Behavior, 20*, 201–223.

Rajagopal, K., Joosten-ten Brinke, D., Van Bruggen, J., & Sloep, P. B. (2012). Understanding Personal Learning Networks: their structure, their content and the networking skills needed to optimally use them. *First Monday, 17*(1), 1-12.

Ribak, A., Jacovi, M., & Soroka, V. (2002). *Ask before you search: peer support and community building with ReachOut.* Paper presented at the ACM Computer Supported Cooperative Work Conference (CSCW 2002), New Orleans, Louisiana.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.): The Free Press, New York.

Roscoe, R. D., & Chi, M. T. H. (2007). Understanding Tutor Learning: Knowledge-Building and Knowledge-Telling in Peer Tutors' Explanations and Questions. *Review of Educational Research, 77*(4), 534-574. doi: 10.3102/0034654307309920

Rovai, A. P. (2002). Building Sense of Community at a Distance. *International Review of Research in Open and Distance Learning, 3*(1), 1-12.

Rusman, E. (2011). *The Mind's Eye on Personal Profiles - How to inform trustworthiness assessments in virtual project teams (Doctoral dissertation)* Open University in the Netherlands (CELSTEC), Heerlen, The Netherlands.

Rusman, E., Van Bruggen, J., Sloep, P. B., & Valcke, M. (2010). The Mind's Eye on Personal Profiles; How to Inform Initial Trustworthiness Assessments in Virtual Project Teams. In G. Kolfschoten, T. Herrmann & S. Lukosch (Eds.), *Lecture Notes in Computer Science: Vol. 6257. Collaboration and Technology. Proceedings of the 16th International Conference CRIWG 2010* (pp. 297-304). Heidelberg, Germany: Springer.

Schnettler, S. (2009). A structured overview of 50 years of small-world research. *Social Networks, 31*(3), 165-178. doi: 10.1016/j.socnet.2008.12.004

Sclater, N. (2009). The organisational impact of open educational resources. In U.-D. Ehlers & D. Schneckenberg (Eds.), *Changing Cultures in Higher Education: Moving Ahead to Future Learning.* Berlin/London: Springer.

Sheehan, K. B. (2015). A change in the climate: Online social capital and the spiral of silence. *First Monday, 20*(5). doi: http://dx.doi.org/10.5210/fm.v20i5

Sloep, P. B. (2004). Reuse, portability and interoperability of learning content: Or why an educational modelling language. In R. McGreal (Ed.), *Online education using learning objects* (pp. 128-137). London: Routledge/Falmer.

Sloep, P. B. (2009a). Fostering Sociability in Learning Networks through Ad-Hoc Transient Communities. In I. M. Purvis & B. T. R. Savarimuthu (Eds.), *Computer-Mediated Social Networking. Proceedings of the First International Conference, ICCMSN 2008* (pp. 62-75). Dunedin, New Zealand, June 2008, revised selected papers: Springer.

Sloep, P. B. (2009b). Section 1: Social Interaction in Learning Networks. In E. J. R. Koper (Ed.), *Learning Network Services for Professional Development* (pp. 13-16). Berlin and Heidelberg: Springer.

Sloep, P. B. (2013). Networked professional learning. In A. Littlejohn & A. Margaryan (Eds.), *Technology-enhanced Professional Learning: Processes, Practices and Tools* (pp. 97–108). London: Routledge.

Sloep, P. B., Berlanga, A. J., Greller, W., Stoyanov, S., Retalis, S., Klink, M. v. d., et al. (2011). *Educational Innovation with Learning Networks: some pertinent tools and developments.* Paper presented at the 2nd International Conference on Technology Enhanced Learning, Quality of Teaching and Reforming Education: Learning Technologies, Quality of Education, Educational Systems, Evaluation, Pedagogies (TECH-EDUCATION 2011). May, 18-20, 2011, Corfu, Greece. http://hdl.handle.net/1820/3305

Sloep, P. B., & Jochems, W. (2007). De e-lerende burger. In J. Steyaert & J. D. Haan (Eds.), *Jaarboek ICT en samenleving 2007; Gewoon digitaal* (pp. 171-187). Amsterdam: Boom.

Sloep, P. B., & Kester, L. (2009). In R. Koper (Ed.), *From Lurker to Active Participant* (pp. 17–27): Springer, Berlin, Heidelberg.

Smith, B. L., & MacGregor, J. T. (1992). What is Collaborative Learning? In A. S. Goodsell, M. Maher, V. Tinto, B. L. Smith & J. T. MacGregor (Eds.), *Collaborative Learning: A Sourcebook for Higher Education.* (pp. 10-30): National Center on Postsecondary Teaching, Learning, and Assessment (NCTLA).

Soffer, S. N., & Vázquez, A. (2005). Network clustering coefficient without degree-correlation biases. *Physical Review E, 71*(5), 057101.

Stahl, G. (2006). *Group Cognition; Computer Support for Building Collaborative Knowledge*: MIT Press, Cambridge, MA.

Stucky, B., & Barab, S. (2007). New Conceptions for Community Design. In R. Andrews & C. Haythomtwaite (Eds.), *The Sage Handbook of E-learning Research* (pp. 439-466). London: Sage.

Sun, N., Rau, P. P.-L., & Ma, L. (2014). Understanding lurkers in online communities: A literature review. *Computers in Human Behavior, 38*, 110-117.

Sutcliffe, A., Wang, D., & Dunbar, R. I. M. (2012). Social relationships and the emergence of social networks. *Journal of Artificial Societies and Social Simulation, 15*(4), 3. Retrieved from http://jasss.soc.surrey.ac.uk/15/4/3.html

TellNet. (2011). D2.1 Data Management. Retrieved from http://www.tellnet.eun.org/web/tellnet/project-document

Terveen, L., & McDonald, D. W. (2005). Social matching: A framework and research agenda. *ACM Trans. Comput.-Hum. Interact., 12*(3), 401-434. doi: http://doi.acm.org/10.1145/1096737.1096740

Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review, 3*(2), 130-154.

Van der Baaren, J., Schuwer, R., Kirschner, P. A., & Hendriks, M. (2008). Finding your way into an open online learning community. *Journal of Interactive Media in Education.*

Van Merriënboer, J. J. G., Kirschner, P. A., Paas, F., Sloep, P. B., & Caniëls, M. C. J. (2009). Towards an integrated approach for research on lifelong learning. *Educational Technology Magazine, 49*(3), 3-15.

Van Rosmalen, P. (2008). *Supporting the tutor in the design and support of adaptive e-learning.* SIKS Dissertation Series No. 2008-07. Onderwijstechnologische Expertisecentrum OTEC., Open Universiteit Nederland, Heerlen. Retrieved from http://dspace.ou.nl/handle/1820/1267

Van Rosmalen, P., Brouns, F., Sloep, P. B., Kester, L., De Jong, A., Berlanga, A. J., et al. (2007, 21-22 June). *A support model for question answering.* Paper presented at the 3rd TENCompetence Open Workshop 'Current Research on IMS Learning Design and Lifelong Competence Development Infrastructures', Barcelona, Spain.

Van Rosmalen, P., Sloep, P. B., Brouns, F., Kester, L., Berlanga, A. J., Bitter-Rijpkema, M., et al. (2008a). A model for online learner support based on selecting appropriate peer tutors. *Journal of Computer Assisted Learning, 24*, 483–493.

Van Rosmalen, P., Sloep, P. B., Brouns, F., Kester, L., Koné, M., & Koper, R. (2006). Knowledge matchmaking in Learning Networks: Alleviating the tutor load by mutually connecting Learning Network users. *British Journal of Educational Technology, 37*(6), 881-895.

Van Rosmalen, P., Sloep, P. B., Kester, L., Brouns, F., de Croock, M., Pannekeet, K., et al. (2008b). A learner support model based on peer tutor selection. *Journal of Computer Assisted Learning, 24*(1), 74-86. doi: doi:10.1111/j.1365-2729.2007.00245.x

Vassileva, J., McCalla, G., & Greer, J. (2003). Multi-Agent Multi-User Modeling in I-Help. *User Modeling and User-Adapted Interaction, 13*(1), 179-210.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology Toward a Unified View. *MIS Quarterly, 27*(3), 425-475. doi: 10.2307/30036540

Vuorikari, R. (2010). Teachers' Professional Development: An Overview of Current Practice. Central Support Service for eTwinning. Retrieved from http://www.etwinning.net/en/pub/discover/publications.htm

Vuorikari, R., Gilleran, A., & Scimeca, S. (2011). *Growing beyond Innovators - ICT-Based School Collaboration in eTwinning*. Paper presented at the Towards Ubiquitous Learning. http://www.springerlink.com/content/e5647123267h3473/

Weber, S. (2004). *The Success of Open Source.* London: Harvard University Press.

Wegerif, R. (1998). The Social Dimension of Asynchronous Learning Networks. *Journal of Asynchronous Learning Networks, 2*(1), 34-49.

Wei, F.-H., & Chen, G.-D. (2006). Collaborative mentor support in a learning context using a ubiquitous discussion forum to facilitate knowledge sharing for lifelong learning. *British Journal of Educational Technology, 37*(6), 917-935. doi: doi:10.1111/j.1467-8535.2006.00674.x

Wenger, E. (1998). Communities of Practice: Learning, Meaning, and Identity. In R. Pea, C. Heath & J. S. Brown (Eds.), (pp. 336): Cambridge University Press, Cambridge.

Wong, W. K., Chan, T. W., Chou, C. Y., Heh, J. S., & Tung, S. H. (2003). Reciprocal tutoring using cognitive tools. *Journal of Computer Assisted Learning, 19*, 416-428.

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Summary

Online learning networks and open educational resources depend on the participation and interaction between their users. It is however no given that these connecting behaviors actually emerge and sustain over time. For example, a new user might be too daunted by the size of the network to ask a question. Or, most users might be connected to the same core users, making the network prone to instability if a core user would fall away. In this thesis we focus on alleviating these problems (and others) by focusing on spreading out connections, making users feel connected, and finally making sure these connections are used in mutual activity. Or, in other words, we want to foster the Social Capital in the network.

Theory and Design

Social Capital is about the relationships some person has and how these are used to gain access to the other's resources and contacts. The main hypothesis of this thesis is that Social Capital can be fostered by introducing a peer-support service called Ad-Hoc Transient Groups (AHTGs). In AHTGs, participants work together in a private surrounding to the ad-hoc request after which the group dissipates. In short, participants that have a learning-related request are helped by other participants in a private space ('ad-hoc') and for only a limited amount of time ('transience').
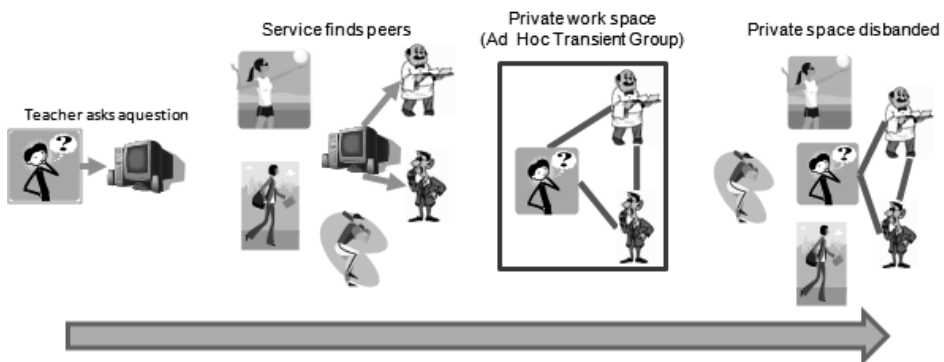
Ad Hoc Transient Groups

AHTGs are hypothesized to foster Social Capital by improving on three Social Capital pillars, namely: Relationship Characteristics, Sense of Connectedness, and Mutual Support. For each pillar, problems reported in the literature are identified (Chapter 2). Together with an explanation of AHTGs, the problems translate into a list of main requirements for the AHTGs peer-support service and how these would affect Social Capital. Based on these requirements, service attributes are defined, providing direct input for the

design as reported in Chapter 3. An initial validation of this design was carried out with users from the so-called eTwinning network, a very large network for secondary teachers in Europe (www.etwinning.net). The feedback of this validation resulted in multiple design changes.

As eTwinning would become the place for our experiments, we needed insight into the specifics of the network, as well as to appreciate why the introduction of AHTGs is especially important for the eTwinning Network. In Chapter 4, data from different sources ranging from surveys to Social Network Analyses are used to give an overview of eTwinning's network state. Based on the results, two perspectives are sketched: of the user and of the network. It is generally concluded that the eTwinning network has established a strong core group that is well interconnected and supported. This core group provides eTwinning with a strong base for the future projects to build on. However, results also indicate that a large number of eTwinners are not connected at all, not to the core network nor to each other in the periphery of the network.

The Experiments

The network approach

In our first experiment (Chapter 5) we focused on the impact of introducing AHTGs on the network as a whole. The first prototype was tested, over the course of three months, with a select group of eTwinners. Participating eTwinners were randomly allocated to an AHTG, Forum, and Control group. The influence of the availability in the network of AHTGs was tested on all three Social Capital pillars (Relationship Characteristics, Sense of Connectedness, and Mutual Support). Results show that AHTGs seem to foster Social Capital at the level of Relationship Characteristics and Mutual Support. Results on Sense of Connectedness were inconclusive. The AHTGs do have a decentralizing effect, making the network less dependent on a few core participants. Furthermore, AHTGs have clearly been shown to have a low threshold to asking a question. In contrast, in the Forum group only a few core participants asked questions, although many participants replied. It is concluded that AHTGs foster Social Capital in a different way than a forum. However, some issues remain outstanding and new issues arose. To address them, another experiment was run, but this time from a user-centric point of view.

The user-centric approach

Combining user feedback and the results of the experiment reported in Chapter 5, an improved, prototype was developed. The experiment reported in Chapter 6 is user oriented, in contrast with the experiment in Chapter 5, which was very much network oriented. This way, results could be examined from a different, more personal point of view. Furthermore, the user-centric approach allows for answering some of the remaining/open issues of the former experiment, with a special focus on the sense of connectedness and the comparison between fora and AHTGs. Usage-logging, surveys, online interviews and social network visualizations were used. The results obtained indicate that, also from a user-centered approach, AHTGs foster Social Capital. Interestingly and adding to what was already suggested by the Chapter 5 results, it is now shown that AHTGs and Forums are significantly different from each other: AHTGs and Forums would often benefit from each others' existence in a network, thus providing users the right tools for their specific needs.

Conclusions and Discussion

Overall conclusions are drawn on AHTGs and their influence on Social Capital in Chapter 7. A first conclusion is that AHTGs foster Social Capital through improving both the relationship characteristics and the mutual support. The influence on the sense of connectedness however remains inconclusive. Furthermore, in combination with earlier research on AHTGs, our results show that AHTGs are ready to be used on a larger scale and adopt their place next to other peer-support methodologies. Yet, just as all the other peer-support methodologies, AHTGs will not suit every need or every situation and need proper planning for them to work. Finally, we discuss the insights on AHTGs and Social Capital gained and what effect the implementation of AHTGs would have on users in a network like eTwinning. We also provide some specific guidelines for Learning Network providers what they have to take into account.

Samenvatting

Online Leernetwerken en open educational resources zijn afhankelijk van de participatie en interactie tussen de gebruikers. Het is echter geen gegeven dat dit verbindende gedrag daadwerkelijk ontstaat. Het kan makkelijk gebeuren dat een nieuwe gebruiker overweldigd wordt door de grootte van het netwerk en geen vraag durft te stellen. Of het kan zijn dat de meeste gebruikers verbonden zijn met een paar kerngebruikers. Het wegvallen van een kerngebruiker zou dan grote gevolgen kunnen hebben voor de stabiliteit van het netwerk. In deze dissertatie richten we ons op het verlichten van deze problemen (en andere) door het accent te leggen op het verspreiden van de connecties, de gebruikers zich onderling verbonden te laten voelen en ervoor te zorgen dat deze connecties daadwerkelijk worden gebruikt voor wederkerige ondersteuning; met andere woorden, we het Sociaal Kapitaal in het netwerk bevorderen.

Theorie en Ontwerp

Sociaal Kapitaal staat voor de relaties tussen mensen en hoe deze relaties gebruikt kunnen worden om de middelen en contacten van anderen te kunnen gebruiken. De hoofdhypothese in deze dissertatie is dat Sociaal Kapitaal bevorderd kan worden door de invoering van een peer-support service genaamd Ad-Hoc Transient Groups (AHTGs). Gebruikers van AHTG's werken samen aan een ad-hoc aanvraag in een privé-omgeving, welke na het oplossen van het vraagstuk of na verloop van tijd weer verdwijnt. Kortgezegd, gebruikers met een leer-gerelateerde aanvraag worden geholpen door andere deelnemers in een privé-omgeving ('ad-hoc') en voor een beperkte tijd ('transience')

Ad Hoc Transient Groups
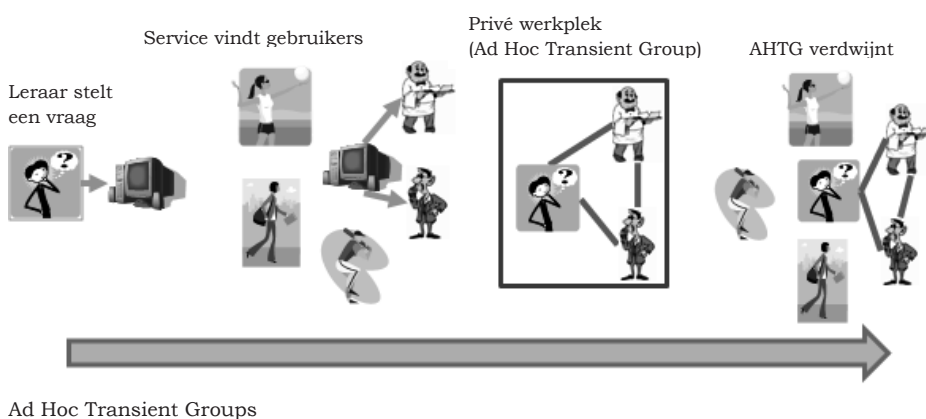
De hypothese is dat AHTG's Sociaal Kapitaal bevorderen op drie verschillende Sociaal-Kapitaal-onderdelen, namelijk: Relatie-eigenschappen, Gevoel

van verbondenheid en Wederkerige ondersteuning. Per onderdeel worden de bijbehorende problemen geïdentificeerd vanuit de literatuur (Hoofdstuk 2). Samen met een uitleg over AHTG's worden de problemen vertaald in een lijst van de belangrijkste benodigdheden voor de AHTG's-service en hoe deze het Sociaal Kapitaal beïnvloeden. Gebaseerd op deze benodigdheden worden bepaalde service-eigenschappen bepaald welke weer direct konden worden gebruikt in het ontwerp (Hoofdstuk 3). Een eerste validatie van het ontwerp werd gedaan met gebruikers van het eTwinning Netwerk. Dit netwerk is zeer groot Europees netwerk voor middelbare-school-docenten (etwinning.net). De feedback leidde tot meerdere veranderingen in ons ontwerp.

Aangezien het eTwinning netwerk de omgeving zou worden voor onze experimenten, was het zaak om eerst inzicht te krijgen in de specifieke eigenschappen van het netwerk. Daarnaast was het ook zaak om nog extra aandacht te geven aan het belang van het introduceren van AHTG's in eTwinning. In Hoofdstuk 4 gebruiken we data van verschillende bronnen zoals een vragenlijst en Sociale-Netwerk-Analyses om een beeld te schetsen van de huidige stand van zaken van eTwinning. Twee verschillende perspectieven worden geschetst aan de hand de gevonden resultaten, dat van de gebruiker en het netwerkperspectief. De conclusie is dat het eTwinning netwerk een sterk ontwikkelde kerngroep heeft welke goed onderling verbonden is met een sterke wederzijdse ondersteuning. Deze kerngroep zorgt ervoor dat eTwinning een sterke basis heeft om in toekomstige projecten op verder te bouwen. De resultaten gaven echter ook aan dat een groot aantal eTwinners helemaal geen connecties hebben, niet met de kerngroep en niet met elkaar.

De experimenten

De netwerkaanpak

In ons eerste experiment (Hoofdstuk 5) legden we de nadruk op de impact die het introduceren van AHTG's heeft op het netwerk in zijn totaliteit. Het eerste prototype werd gedurende drie maanden getest met een selecte groep eTwinners. Participerende eTwinners werden aselect toegewezen aan de AHTG-, Forum-, en Controle-groep. De invloed van AHTG's op het Sociaal Kapitaal werd getest voor de drie Sociaal-Kapitaal-onderdelen (Relatie-eigenschappen, Gevoel van verbondenheid, Wederkerige ondersteuning). Resultaten laten zien dat AHTG's inderdaad het Sociaal Kapitaal lijken te bevorderen op het gebied van Relatie-eigenschappen en Wederkerige ondersteuning. De resultaten op het gebied van het Gevoel van verbondenheid lieten het trekken van een bepaalde conclusie niet toe. AHTG's hebben een

decentraliserend effect, ze maken het netwerk minder afhankelijk van een kleine groep kerngebruikers. Ook laten we zien dat AHTG's het gebruikers een stuk makkelijker maken om een vraag te stellen. In de Forumgroep bijvoorbeeld waren er maar een paar kerngebruikers die vragen stelden, maar waren er velen die antwoord gaven. De conclusie is dan ook dat AHTG's Sociaal Kapitaal op een andere manier bevorderen dan Fora. Tegelijkertijd waren er een aantal onderzoeksvragen die open bleven en kwamen er nieuwe onderzoeksvragen op. Om deze te beantwoorden werd een tweede experiment opgezet, maar dit keer met de gebruiker centraal.

De gebruikersaanpak

Een nieuw verbeterd prototype werd ontwikkeld door gebruikersfeedback en de resultaten van het in Hoofdstuk 5 beschreven experiment te combineren. Het experiment in hoofdstuk 6 is gericht op de gebruiker in plaats van op het netwerk, zoals in hoofdstuk 5 het geval was. Op deze manier konden de resultaten vanuit een andere, meer persoonlijke hoek worden bekeken. De gebruikersaanpak liet ook het beantwoorden van vragen toe waarbij een speciaal accent lag op het Gevoel van verbondenheid en het verschil tussen Fora en AHTG's. Usage-logging, vragenlijsten, online interviews en sociale netwerk visualisaties werden hiervoor gebruikt. De resultaten geven aan dat ook vanuit het gebruikersperspectief AHTG's de groei van Sociaal Kapitaal bevorderen. Ook was opmerkelijk dat Fora en AHGT's inderdaad verschillend van elkaar zijn. De conclusie is dan ook dat Fora en AHTG's een goede, elkaar versterkende combinatie vormen in een netwerk, met elk zijn eigen voordelen.

Conclusies en Discussie

De algemene conclusies over AHTG's en hun invloed op Sociaal Kapitaal worden besproken in Hoofdstuk 7. De eerste conclusie is dat AHTG's Sociaal Kapitaal bevorderen door zowel de relatie-eigenschappen als de wederkerige ondersteuning te verbeteren. De invloed van AHTG's op het gevoel van verbondenheid blijft echter open voor discussie. Hierop volgend is onze conclusie dat ons werk, gecombineerd met eerder werk op het gebied van AHTG',s de weg vrij maakt voor een grootschalige implementatie. Maar net als alle andere peer-support methoden zijn AHTG's niet in elke instantie inzetbaar en vereisen ze een goede voorbereiding willen ze een kans van slagen hebben. Als laatste bespreken we onze inzichten op het gebied van AHTG's en Sociaal Kapitaal en wat het effect zou zijn van de implementatie van AHTG's op een netwerk als eTwinning.

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