Work-Based Networked Learning: a bottom-up approach to stimulate the professional development of teachers

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Abstract

Networked learning is an important driver for informal professional development and workplace learning based on social relationships. However powerful networked learning may be, there is a problem when it comes to making it a real asset within organizations. This may seem as a paradox, but networked learning activities are mostly invisible to others, sometimes the learners themselves might not even be aware of the learning that occurs. As a consequence networked learning in organizations goes undetected, remains off the radar of HR departments and is therefore hard to asses, manage and value (Wenger, Trayner, & De Laat, 2011). Bearing this in mind we acknowledge a great need for empirical research and tools that can raise awareness about networked learning activities to make it visible, amplify the benefits of it and strengthen the social relations through which it occurs. Through our research practice we have experimented with several visualization methods of informal learning networks (De Laat, 2011; Haythornthwaite & De Laat, 2012) and developed a research methodology around this practice, We will present the results of a descriptive study conducted with 22 teachers in a secondary school in the Netherlands alongside the design guidelines for a research practice to visualize (personal) professional development networks driven by networked learning issues. The goal of this paper is to increase our understanding of how we can make networked learning activities visible and as a consequence help organisations to support a bottom-up approach to stimulate professional development amongst teachers.

Keywords

Social Network Analysis, Networked Learning, Work-Based Learning, Professional Development Networks

Teacher quality is the most important factor influencing outcomes of education. As a result numerous research studies have been conducted to study the effect of professional development activities on teacher practice and student achievements. International review studies recognize a consensus in these studies concerning professional development effectiveness: Studies agree that teacher professional development is more likely to enhance instructional practice and student learning (Borko, 2004; Blokhuis, 2006; Geijsel, Sleegers, Stoel & Krüger, 2009; Hodkinson & Hodkinson, 2005; Kwakman, 2003; Musanti & Pence, 2010) if it is (1) sustained and intensive, (2) content driven, (3) accompanied by hands-on work, (4) collaborative and (5) integrated within the daily work of the teacher (Borko, 2004; Garet, 2001).

Organizations, when thinking of professional development, often rely on refreshment courses given by experts, in-service training, or personalised learning trajectories. But formal learning activities like training and workshops are often seen as less effective due to the fact trainings are to 'far' away from the daily practice and teachers find it difficult to transform the insights gained in formal trainings to concrete expertise usable in their daily teaching. Therefore both research literature and educational institutions are moving beyond the restriction of traditional activities such as workshops and short trainings to encompass a more complex and broader view on professional development. Teachers are involved in numerous activities and interactions that may increase their knowledge and teaching skills: from formal seminars and workshops to informal discussions with colleagues at the coffee machine (Desimone, 2009). At the same time there is a large body of research that convincingly shows that forms of informal work related learning are important drivers for professional

development (Berings, 2006; De Laat, 2011; Eraut, 2000; Marsick & Watkins, 1990; Smith, 2008). Also teachers themselves place a high value on learning informally (yet strategically) with and from each other (Armour & Yelling, 2007). But until now, there is no common agreement on what informal learning characterises or how it can be measured. Often, informal learning is contrasted to formal learning - the hierarchically structured, chronologically graded education system. Others make a distinction referring to the context in which the learning occurs, for example in a formal curriculum – a workshop – or informal activities (Smith, 2008). Recently a shared notion is that the social aspect of informal learning is often overlooked and that we need to pay attention to the cultural and social relations that characterize informal learning in the workplace (Eraut, 2004; Smith, 2008). Here we follow Eraut (2004) and De Laat (2011): Informal learning is often asserted to deal with implicit knowledge, occurs in a social setting, is embedded in day-to-day practice and is a result of spontaneous learning activities (Billett, 2001; Davenport & Prusak, 2000; Eraut, 2000; Marsick, 2001; Star & Strauss, 1999; Timmermans, Bowker, & Star, 1998). Indeed, informal learning in the workplace is often described as observing how others do things, asking questions, trial and error, sharing stories with others and casual conversation (Cross, 2006; Wenger, Trayner & De Laat, 2011). Also Kwakman (2003) specified collaboration as an important learning activity at work, next to reading, experimenting and reflecting.

To study informal learning activities from this social perspective we can build on Networked Learning Theory. Networked Learning Theory is an emerging perspective that tries to understand learning by asking the question how people develop and maintain a 'web' of social relations used for their own and reciprocal learning and professional development. Here we define Networked Learning as a form of informal learning situated in practice, where people rely strongly on their social contacts for assistance and development (De Laat & Coenders, 2011; Jones, Asensio & Goodyear, 2000). Recent research has provided evidence linking Networked Learning to an array of positive outcomes like student performance and school improvement (Coburn & Russell, 2008; Earl & Katz, 2007; McCormick et al., 2010; Moolenaar, Daly, & Sleegers, 2010; Penuel et al., 2010; Pil & Leana 2009). In schools, professional development involves opportunities for teachers to share their expertise, learn from peers, and collaborate on real-world projects (Vrasidas & Glass, 2004). This approach to learning embraces the participation metaphor (Lave & Wenger, 1991; Sfard, 1998) where learning is seen as situated, embedded and maintained in the daily culture of shared and connected practices and professional standards. A network in this sense can be regarded as a web of social relationships among teachers that reflects the flow of resources among them. Learning in this setting can be regarded as a relation that connects people (for example students learn from a teacher, professionals learn from their colleagues) and learning can be seen as the outcome of relations (a group acquires competence in technology use, a community holds a knowledge of its history, and information resources for dealing with new situations) (Haythornthwaite, 2008). We therefore acknowledge Networked Learning is a form of bottom-up knowledge creation, because teachers themselves learn from and with each other and develop learning outcomes through their interactions. Networked learning theory is useful for our analysis, moreover because it is closely linked to and uses methodologies of Social Network Theory. According to Moreno (1947) Sociometric tests, the forerunner of Social Network Theory, shows "in a dramatic and precise fashion that every group has beneath its superficial, tangible, visible, readable structure an underlying intangible, invisible, unofficial structure, but one which is more alive, real and dynamic than the other." (Moreno, 1947, p. 268) To investigate the dynamics of informal learning (networks) it is exactly this invisible and informal structure this study wants to bring to light.

However promising Networked Learning may be, there is a problem when it comes to making it a real asset within organizations. This may seem as a paradox, but Networked Learning activities are hard to manage and research because informal learning is often invisible to others and even the learners themselves may not be aware of the learning that occurs. The knowledge acquired can be tacit and the informal learning activities are not corresponding to the traditional idea of learning as codified propositional knowledge (Eraut, 2004). As a consequence Networked Learning in organizations goes undetected, remain off the radar of HR departments and management staff and are therefore hard to asses, manage and value (Wenger, Trayner & De Laat, 2011). Yet, while empirical evidence on the value of teacher relationships for teacher and student learning is growing, there is a dearth of work on how the dynamic structure of the learning networks can impact teachers' professional development.

Therefore a great need is recognized in research, policy and practice to investigate the impact of networked learning further in the context of professional development. By doing so we can make the bottom-up learning more visible and create insights into how we can support the learning networks to become more efficient and embedded within an organisation. This leads to the following main research question in this paper: How can Networked Learning help to visualize teachers' professional development?

Proceedings of the 8th International Conference on Networked Learning 2012 , Edited by: Hodgson V, Jones C, de Laat M, McConnell D, Ryberg T & Sloep P

ISBN 978-1-86220-283-2

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Research methodology

To investigate the networked learning activities within a team of 24 teachers we made use of a mixed methods approach to triangulate several data sources (De Laat, 2006). The aim of this multi-method approach is to paint a more complete picture of networked learning processes teacher in professional development networks are engaged in. This multi-method research framework combines data collection method based on social network analysis (SNA) to find out 'who is talking to whom', content analysis (CA) to find out 'what they are talking about', and contextual analysis (CxA) focusing on the experiences and settings of the participants to find out 'why they are talking as they do'.

The school participated in the study as part of a school improvement plan focused on teacher professional development in the use of ICT. 22 teachers from a vocational school in the Netherlands participated in the study.

These three methods are used to triangulate, validate and contextualise our findings and to stay close or be connected to the first-hand experiences of the participants themselves.

Step1: SNA – Make Learning Networks Visual

We believe that an important first step to analyse networked learning activities, is to make networked learning visual. By visualizing networked learning, people can see who is involved, assess what they produce, participate, and value it. As such these network visualizations serve as a kind of mediating artefact boot strapping conversations about networked learning activities in organizations and strengthen their learning relationships. This we feel is needed in order for networked learning to become recognized, supported and legitimized as a powerful form of bottom-up learning along side formal learning initiatives. The aim of this step is to visualize teacher professional development networks and determine one's ego-network within these networks.
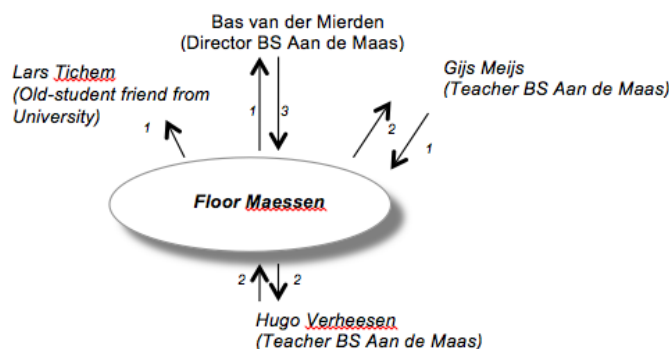
How this methodology developed over time

For years we are now following teacher networks for professional development using a paper-based version for drawing network connectivity on so called contact cards. The paper-based method for collecting contact cards has developed over time. In the first project, we used an online questionnaire in which participants (N=52) could indicate 5 colleagues with whom they interacted concerning a certain topic related to their own learning / professional development (De Laat, 2011). The names were available in a list and participants could select the names. The limitation of this method is that we could only collect information about relationships amongst their colleagues, therefore excluding other types of relationships. To address this, we included an open question in which they could type the name of any contact they had in relation to that particular learning topic. Unfortunately none of the respondents filled in the extra question. To tackle this problem we created a more accessible open-ended paper-based version to create contact cards, combined with a clear set of instructions. Later on we asked participants to draw a graphical presentation of the people they engage and learn from around a particular topic and how frequent (1-5) they meet (see figure 1 for an example of a contact card).

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ISBN 978-1-86220-283-2

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Figure 1. Example of a paper-based contact card. The informal network of Floor Maessen on using white a board.

This task is done with 1 or maximum 2 teachers at a time, preceded by an elaborated instruction, both oral and paper-based. We ask participants to start from the individual perspective (ego-network), by putting him or her name at the centre of his own social learning space, and ask them to draw all social connections they rely upon for one particular learning challenge or work related problem. This methodology has been applied with over 150 teachers and management staff in 5 different projects to study their networks for informal learning.

Based on the drawings we build case-by-case matrices for every school, group or team we investigate. With this approach we collect data to measure the main metrics of Social Network Analysis. By connecting the contact cards of personal networks into organizational networks we traverse between ego- and whole network perspectives and shed a light on the information flow between informal learning networks within the organization and the expertise the organization taps into related to particular learning topics (see figure 3 for an example).

Results Step1: Social Network Analysis

We used UCINET (Borgatti, Everett, & Freeman,2002) to conduct Social Network Analysis. The network data is used to measure the density of a network, the centrality of persons within a network, detect key persons and investigate the structure of the network (Borgatti, Everett, & Freeman,2002; Scott, 1991).

Density of the network

By calculating the density of the network, this is the proportion of ties within the network, we know how well the networked learning activities is distributed within the team. In this case the density of the network is only 11%. This means there are only 46 ties out of the 399 (N of Obs) connections, see table 2.

Table 2. Density statistics of the informal network of project 2 based on a whole network perspective

Density	Std Dev	No. Of Ties	Variance	N of Obs
0.1153	0.319	46.000	0.102	399.000

Key persons: Indegree and Outdegree

Secondly we looked at the ego-perspective. We started with calculating the out-degree centrality (number of ties that an actor directs to others) which indicates the extent to which an individual interacts with other members in the network (Wasserman & Faust, 1994). To investigate informal learning activities it is important to gather data about the reciprocity of the relations. In this respect we cannot only see if a person reaches out to colleagues to learn with, we can also measure if an individual is approached by others to learn from. In table 3 you can see the in-degree and out-degree of the individuals involved in the network. 2 teachers have an out-degree of 0.000 because they did not fill in the contact card (12 Goronwy and 7 Gopal) the other teachers with an outdegree of 0.000 did not indicate any form of learning relation with one of their team members. However from a learning perspective for example it is interesting to see that Gopal has an in-degree of 4. This means that 4 teachers indicated Gopal as a person they learn from. Teacher 16, 18, 8 and 4 are the ones that reach out the most to others to learn from about the use of ICT in education. On the other hand teacher 22, 20, 1, 10 and 7 are the ones who are most approached by other teachers to learn from.

Table 3 Freeman's degree centrality measures

		OutDegree	InDegree	NrmOutDeg	NrmInDeg
16	Govinda	6.000	3.000	28.571	14.286
18	Grady	5.000	1.000	23.810	4.762
8	Gordon	5.000	0.000	23.810	0.000
4	Gomer	5.000	2.000	23.810	9.524
6	Gonzalo	3.000	1.000	14.286	4.762
11	Gorman	3.000	0.000	14.286	0.000
2	Golding	3.000	1.000	14.286	4.762
22	Grandpro	3.000	7.000	14.286	33.333
20	Graham	3.000	5.000	14.286	23.810
3	Goliath	2.000	0.000	9.524	0.000

17	Gower	2.000	0.000	9.524	0.000
15	Gough	2.000	1.000	9.524	4.762
19	Graeme	2.000	1.000	9.524	4.762
5	Gomez	1.000	1.000	4.762	4.762
13	Gorran	1.000	0.000	4.762	0.000
1	Godwin	0.000	5.000	0.000	23.810
10	Gore	0.000	5.000	0.000	23.810
7	Gopal	0.000	4.000	0.000	19.048
14	Gottfried	0.000	2.000	0.000	9.524
9	Gordy	0.000	1.000	0.000	4.762
21	Gram	0.000	6.000	0.000	28.571
12	Goronwy	0.000	0.000	0.000	0.000

Table 4 descriptive statistics of Freeman's degree centrality

		OutDegree	InDegree	NrmOutDeg	NrmInDeg
1	Mean	2.091	2.091	9.957	9.957
2	Std Dev	1.881	2.172	8.956	10.344
3	Sum	46.000	46.000	219.048	219.048
4	Variance	3.537	4.719	80.208	107.007
5	SSQ	174.000	200.000	3945.578	4535.147
6	MCSSQ	77.818	103.818	1764.585	2354.154
7	Euc Norm	13.191	14.142	62.814	67.344
8	Minimum	0.000	0.000	0.000	0.000
9	Maximum	6.000	7.000	28.571	33.333
10	N of Obs	22.000	22.000	22.000	22.000

Network Centralization (Outdegree) = 19.501%   Network Centralization (Indegree) = 24.490%

The Network Structure
Finally it is also possible to visualize attribute data about the ties and/or nodes within a network. These attributes can show additional properties embedded within the network. In our project 2 for example we received additional data about the two different locations where these teachers are working. Based on this data we created, with the use of Netdraw, a graphical representation of the ICT informal learning network present within the school (see figure 2). As you can see in figure 2, teachers indicate proportionally more to have a learning tie with teachers working at the same location (location 1 is indicated with a red node, location 2 with a blue node).

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ISBN 978-1-86220-283-2

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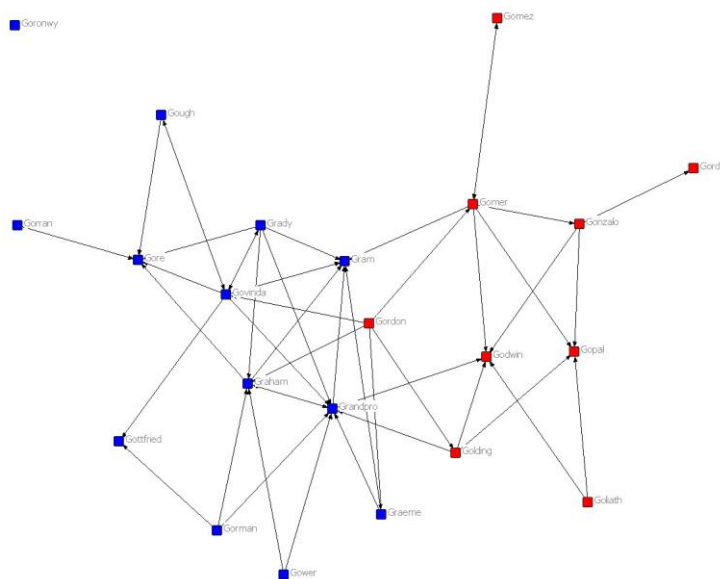
Figure 2 A multidimensional graph of informal professional development networks (combining ego-networks and whole-organisational network, including actor location)

Step 2 Content Analysis

For step 2 we conducted an interview to find out what these learning relationships are about. During this step a lot of attention is paid to the questions referring to the nature of a learning tie, how they are created and maintained, what learning strategies and competencies are used. To stimulate the bottom-up approach we decided to organise a group interview with all 22 team members. The visualizations of the first step was used as a mediating artefact to guide the discussion. The following questions were asked:
Content Analysis: What kind of expertise and experiences do you share in these learning relations?

Results Step 2

The centrality of the key persons was explained during this group interview by the content of their expertise. In the red team Gopal was the overall ICT expert, in the blue team Grandpro had the highest indegree because she has the knowledge about integrating videos into powerpoint, an ICT application most teachers need in their classroom teaching. Graham (highest Indegree) was responsible for the support of the online environment of the blue team. Only three subjects were mentioned: the use of PowerPoint in the classroom, the use of video and video material in PowerPoint and the use of the new online earning environment for teachers. The limited amount of ICT use and related learning questions around ICT could be an explanation for the low network density 0.1153.

Step 3 Context analysis.

To get an insight into the context the following questions were asked during the same team meeting:
Do you think the network visualisation represents the real setting?; What strikes you in this visualisation? What is your explanation for this?;
On top of the group interview we held an interview with the team manager to reflect on the results of the team session.

Results Step 3

During the team discussion all team members agreed that the visualisation represented the real setting, except for Gopal. Because she did not fill in the contact cards, her position in the network was not correct. Due to the fact her indegree is 4 , her position would be more centred in the network. The first thing that stroke them the most was that the network structure represented their physical division. They also pointed out that they saw in the visualisation that the density of the network in location blue is much higher then in location red. They mentioned two reasons for this distinction: The teachers in the blue location, the one with a higher density, uses an online learning environment to support their teaching. The teachers assumed that the use of this learning environment triggers more learning questions about the use of this online environment in their teaching and therefore stimulate teachers to create more learning ties around the use of ICT. Secondly the red location team said that Gopal, the most central person in the red team network, is really the ICT expert in the team and everybody goes to him for questions, rather then asking and sharing expertise amongst the whole team.
To further stimulate the bottom-up approach we asked the team to formulate solutions to stimulate the uptake of ICT in the classroom and therefore stimulate the knowledge exchange and relation building around the topic within the team. To stimulate the exchange amongst the overall network and to stimulate the knowledge sharing between the two locations, the team suggested to implement the use of the online learning environment in both locations. At the same time, the teachers asked to also use this environment to share information across the two locations. Secondly they proposed to use team meetings to share information about the use of ICT. The key persons (with highest indegree), the central ICT experts, were asked to share their knowledge and distribute their expertise throughout the overall learning network through information sessions during the team meetings. Finding out about peoples position in this learning network is interesting for the school district project. In the beginning 3 key persons were approached to promote the use of ICT in their team. The Social Network Analysis showed that instead of only 3 key persons we see that 5 actors who are being frequently approached. This finding is supported by a in-degree centralization of 24,5% (see table 4). This could help to team leader to set-up a core team of ICT experts, identify different roles and strategies of the actors within the network that influence networked learning activities. 10 months after the first measurement, a second social network analysis will be made, to compare data and to see if we can detect a growth in the overall network density, a shift in the network centrality and a shift in the positions of the team members within the network. To conclude we can say that the team members themselves, put a value in the ICT Networked Learning approach. After each visualisation we ask the participants to fill in a question about the importance of the learning networks they are involved in for their personal development (1= not important at all; 2= not important, 3= neutral; 4= important;

5= very important). As you can see in table 5 the mean is very high. Most respondents find their social learning network a very important revenue for their own professional development.

Table 5: Descriptive Statistics importance of learning network for own professional development

N	Minimum	Maximum	Mean	Std. Deviation
18	2	5	4,05	0,802

Conclusion

In our research on social professional development networks among teachers in and between schools, we find that working with these visualizations stimulates a networking attitude amongst teachers in the school towards learning. They become aware that they are not alone in their classroom and that professional development is also a social activity; one that is spontaneous and deeply connected to day-to-day challenges in the workplace. Another advantage of these visualizations is that they serve as very concrete artefacts for the teachers to help them reflect on how they act as networkers building a social space for informal learning.

This research shows that the presented methodology is a useful research driven intervention tool to detect, connect and facilitate informal networked learning. With this methodology we can detect multiple (isolated) networks in the organization and connect ideas and stimulate participants to think of solutions to support their own professional development in certain domains. Using this approach, organizations can link in with existing informal networks of practice and unlock their potential for organizational learning by giving them a voice and make their results more explicit within the organization. This way we can overcome some of the traditional weaknesses of informal learning referred to in the introduction: make informal learning visible and make it possible to organise effective support to stimulate exchange of knowledge en expertise spontaneous and in the daily practice. Within this work there is a tendency to move away from an emphasis on training towards a focus on learning; seeing working and learning as one and the same. In this light professional development is a continuing process of acting, reflecting, and changing day-to-day practices. This perspective gives rise to a more bottom-up – self governing - understanding of learning where workers with their colleagues interact about their work experiences through sharing their experiences, knowledge and contacts providing access to new or alternative resources.

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Proceedings of the 8th International Conference on Networked Learning 2012 , Edited by: Hodgson V, Jones C, de Laat M, McConnell D, Ryberg T & Sloep P

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Hodgson V, Jones C, de Laat M, McConnell D,
Ryberg T & Sloep P

ISBN 978-1-86220-283-2

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ISBN 978-1-86220-283-2

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