Open Research Online

The Open University's repository of research publications
and other research outputs

Discovering academics' key learning connections: An ego-centric network approach to analysing learning about teaching

Journal Item

oro.open.ac.uk

Discovering academics' key learning connections: An ego-centric network approach to analysing learning about teaching

Nino Pataraia, Anoush Margaryan, Isobel Falconer, Allison Littlejohn, Jennifer Falconer

Caledonian Academy, Glasgow Caledonian University, Glasgow, UK

The aim of this exploratory study is to investigate the role of personal networks in supporting academics' professional learning about teaching. As part of a wider project, the paper focuses on the composition of academics' networks and possible implications of network tendencies for academics' learning about teaching. The study adopts a mixed-method approach. Firstly, the composition of academics' networks is examined using Social Network Analysis. Secondly, the role of these networks in academics' learning about teaching is analysed through semi-structured interviews. Findings reveal the prevalence of localised and strong-tie connections, which could inhibit opportunities for effective learning and spread of innovations in teaching. The study highlights the need to promote connectivity within and across institutions, creating favourable conditions for effective professional development.

Keywords: Personal learning networks, social network analysis, egocentric network analysis, teaching, Higher Education, workplace learning

Introduction

The prominence of networking and other forms of social exchange for both individual and organisational learning is widely acknowledged (Ancori *et al*., 2000; Cross *et al*., 2001). It is a commonly held belief in education that 'networks generate powerful professional learning' (Lima, 2008: 13). Various researchers describe networks as a key source of teachers' professional development and highlight their vital role in equipping teachers with a sense of empowerment, providing emotional support, enhancing engagement in teaching, and enabling teachers to take ownership of curricula (Baker-

Doyle, 2011; Lieberman and Miller, 1999; Lieberman and Wood, 2003). However, research on the role of networks in professional development of teachers has predominantly been carried out in relation to formal, institutionally-provided networks in compulsory education contexts (Baker-Doyle and Yoon, 2011; McCormick *et al.*, 2011). Kerr et al (2003) have recognised the need for examining such networks from an individual standpoint given that most existing research comes from the perspective of network coordinators rather than that of the participants. There is a paucity of studies examining personal networks of academics in higher education. In particular, there is limited understanding of the way in which academics utilise the resources available through their networks, or how networks in general support their practice and professional development. Further, Borgatti and Cross (2003) have pointed out that our understanding of the specific types of relationship that are conducive to learning in networks is limited.

This study responds to these calls for additional research, by focusing on who academics learn new teaching practices from through their personal networks, and how the composition of their networks might shape their professional teaching practice. It analyses the role of networks from the perspective of individual academics, supplementing extant research which focused on whole network perspective. The paper commences with the introduction of key theoretical concepts and an overview of previous empirical research. Subsequently, research methods are outlined, followed by a discussion of the results. The conclusion summarises key observations, outlines limitations of the study, and offers recommendations for further research.

Literature Review

In this study learning is conceived as the acquisition of new ideas, knowledge, skills,

and dispositions related to teaching practice, assuming that this is likely to occur through social interactions with other knowledgeable peers. We use social network theory to describe the interactions of academics. A social network comprises the individuals (actors or agents) and the interactional links or ties between them, and network theory provides ways of describing both the properties of the ties and the overall structure of the ties. The interactions comprising the ties may take the form of exchange of knowledge, materials, resources, and advice (De Laat, 2011). Since authors such as Eraut(2007), Scardamalia and Bereiter (2003), Koopmans et al (2006), Schulz and Geithner (2010), Katz et al (2009) and Tynjala (2008) have emphasised the importance of dialogue and social interaction for sharing ideas, experiences and concepts during learning, we consider that networks are a potential locus for academics' professional learning.

Through their networks individuals gain access to resources, information and guidance (Kadushin, 2011). Consequently, the characteristics of the networks in which individuals are embedded have a significant influence on what individuals know or what type of information they have (Cross and Parker, 2004). Social network analysis (SNA) is widely used to uncover relational patterns and to understand their influence (Burt, 1995). SNA allows representing and measuring the ties between people and among sets of people as well as explaining the causes and implications of these relationships (Knoke and Yang, 2008). There are two distinct types of SNA: the egocentric (personal network) and the sociocentric (whole network) (Cross and Parker, 2004). The sociocentric approach takes a bird's eye view of social structure, focusing on the pattern of relationships between people within a socially-defined group. In contrast, the egocentric, personal network analysis centres on individuals and their connections (Scott and Carrington, 2011). The personal network approach is primarily used for

understanding the phenomena of interest at a local (individual) rather than at a global (whole network) level; it can be used to answer questions regarding the impact of network ties on an individual actor's behaviour and to identify which types of ties are most or least significant to individual network members.

We adopt the egocentric network approach because our interest is in analysing academics' learning at an individual, rather than a whole-network, level, responding to Kerr et al's (2003) call discussed above. That is, our intention is to examine how an individual learns about new teaching practices within or through a network. Also, our goal is to uncover the connections that individual academics consider the most significant, regardless of where these connections are based. We draw on the definition of "personal learning network" (PLN) introduced by Tobin: a PLN is "a group of people who can guide your learning, point you to learning opportunities, answer your questions, and give you the benefit of their own knowledge and experience" (Tobin, 1998). A PLN can be facilitated by technology, be face-to-face, or a combination of both (Way, 2012).

In the context of business organisations, Cross and Parker (2004) observed that individuals' personal learning networks often reveal homogeneity in terms of gender, work-experience level, and occupation. The tendency they observed of individuals to associate, bond and interact with similar others is termed homophily. Cross and Parker argued that the degree and type of homophily in a network has implications for what individuals learn through the network. Homophily has been investigated in different types of relationship and its role in network formation is well documented (Marsden, 1988). Such research shows that geographic proximity and isomorphic positions in social systems often create a context in which homophilous relations are formed (McPherson, Smith-Lovin and Cook, 2001). However, to date, homophily has not been

4

examined with regard to relationships in academics' learning of new teaching practices, so in this study we investigate what characteristics are significant for forming homophilous relationships.

In addition to homophily, Cross and Parker (2004) outlined six dimensions of personal learning networks in business organisations, and common tendencies in those dimensions which could impact on what is learnt:

(1) Relative hierarchical position: Overreliance on people occupying certain hierarchical positions can impede learning. Networking only with those who are at the same hierarchical level can be as detrimental as interacting with only those above or below.

(2) Connecting with people in the home institution: People tend to reach out to people in the home department for learning purposes rather than bridging relationships across or beyond the local institution.

(3) Physical proximity: The probability of interacting with others decreases with distance, due to a corresponding reduction in the probability of serendipitous interactions.

(4) Structure of interactions: Individuals have a strong tendency to seek knowledge from people that they encounter in the course of their normal work flow.

(5) Time invested in maintaining relationships: People often fail to invest an adequate time in cultivating and maintaining relationships that are crucial for learning.

(6) Length of time known: Diversity in terms of the length of time one has known his/her contacts is important in personal networks.

According to Cross and Parker (2004), balance with regard to the above tendencies is beneficial for learning. These tendencies and their impact on learning have so far been studied only in non-academic, corporate settings. We examine whether similar tendencies exist in academics' learning networks. If such tendencies were evident then what would be the potential implications for developing teaching practice?

Granovetter (1973) developed a theory of the strength of ties, describing strong ties in terms of emotions/time invested in relationships, and weak ties with a lower investment of time and intimacy. Friendship and familial relationships are examples of strong ties. Although such ties facilitate the transfer of tacit, sensitive and complex knowledge, they potentially inhibit collection of new information (Reagans and McEvily, 2003). In contrast, casual acquaintances or friends of friends, examples of weak ties, serve as links between dispersed social circles, potentially offering access to novel, non-redundant information, ideas and resources (Granovetter, 1973). There are a number of ways for measuring tie strength, such as emotional, social closeness/ friendship, reciprocity, and frequency of interaction (Burt, 1995). In this study, it is measured on the basis of friendship.

Research in Organisational Science shows that professional relationships offer both instrumental (career) and expressive (emotional) support (Gersick *et al*., 2000). Instrumental relations provide resources such as professional advice, information, encouragement and expertise, whereas expressive relationships, characterised by a high degree of trust, offer friendship, support, and easy ways of communicating information (Ibarra, 1993). It is fairly common for networks to contain both instrumental and expressive ties (Lincoln and Miller 1979), triggering enhanced access to information, opportunities, and support.

The composition of academics' general networks has been described as dynamic and complex, comprising a variety of affiliations, including co-workers (within same department or institution), former colleagues, cross-disciplinary collaborators, family members and friends (Pfifer, 2010). Hinds *et al* (2000) demonstrated that academics gravitate toward other academics. However, even their task-related networks overlap with connections based on friendship, advice, socialising, and general support. Hence, it is quite common for academics to have multiplex relationships (having more than one kind of relationship, for instance, co-worker and friend) with the same contact (Haines *et al*., 1996). However, these studies have examined academics' general networks, rather than those specifically related to learning about new teaching practices.

Overall, this article is structured around the following research questions:

Q1. What are the main characteristics of academics' personal learning networks relating to teaching practice?

Q2. Does homophily affect the formation of academics' personal learning networks, and if it does, what are the most significant homophilous characteristics?

Q3. Do participants' personal learning networks show tendencies with regard to six dimensions of network relationships (relative hierarchical position, connecting with people in the home institution, physical proximity, structure of interactions, time invested in maintaining relationships and length of time known) and what are the possible implications for learning new teaching practices?

While the first question seeks to identify the overall form of academics' learning networks relating to teaching, the second and third shed light on the relationships comprising those networks, by revealing the factors that influence the formation of learning ties (connections) and the potential outcomes of these relationships.

Methodology

Data collection procedure

SNA survey and Interviews

The study was carried out in two stages, combining quantitative and qualitative methods: an SNA survey followed by semi-structured interviews.

We used a non-probability, convenience sampling strategy (Kuzel, 1992). Firstly, an email invitation to complete the survey was sent out by a number of gatekeepers as well as through discipline-based mailing lists in Biosciences, Business, Engineering and a number of. Survey participants were invited to volunteer for a follow-up interview.

Secondly, participants who volunteered for an interview were sent the interview protocol detailing the aim of the study, interview structure, interview questions and ethical issues.

Data collection instruments

SNA questionnaire survey

 The SNA survey was based on an extant instrument (Cross and Parker, 2004: 150). It included a name generator instrument that asked participants to identify individuals with whom she or he has a specific relationship (Knoke and Yang, 2008). Three commonly applied constraints (Campbell and Lee, 1991) were built into our name generator instrument to obtain a manageable list of participants' significant contacts:

(1) ***Role/content constraint*** limiting participants to only one, or a few, types of relations. In this study participants were asked to focus on those relations that had contributed to their learning of different teaching practices.

(2) *Temporal constraint* requiring participants to identify their contacts within a certain period. For this study, one year was the time-frame.

(3) *Numerical constraint* restricting participants to naming only N persons. Our participants were requested to elicit their five to ten most significant connections**.**

The key part of the name generator instrument asked, "Please list either initials or pseudo names of up to 10 key people who have contributed to your learning of different teaching practices during the last 12 months. You can add as few or as many contacts as you like, but please try to add at least 5."

The survey also included "interpreter" questions, asking participants about their contacts' roles, physical proximity, experience, the frequency of interaction, and whether they considered them as friends (Marsden and Campbell, 2005).

The full SNA survey, detailing all the questions, is available from

https://www.dropbox.com/sh/mthp3gdjmhxy3vn/DfBcSM7vg8

Interview protocol

Network graphs of participants' learning networks and a sociomatrix (a tabular display of social network data, see Knoke and Yang, 2008) were constructed prior to the interviews, based on survey responses. Interviews lasted on average an hour. During the first part of the interview, participants were presented with a sociomatrix based on their own survey response and asked to indicate whether there were connections between the nominated contacts. During the second part of the interviews, network graphs were used to aid participants' reflection on their network activities (from whom, how and what academics learned through their connections), the constitution and dynamics of networks and their perception of network benefits. The interview script is available

from https: //www.dropbox.com/sh/mthp3gdjmhxy3vn/DfBcSM7vg8 .

Data Analysis procedure

Survey data analysis

Survey analysis included both descriptive and inferential statistical analyses using SPSS and E-NET. Given that variables of interest were qualitative, we used frequencies to obtain descriptive statistics (Pallant, 2010). Chi-square tests were utilised to determine the statistically significant relationship between variables. Since the chi-square statistic can be distorted when cell sizes are less than n=5 (Gravetter and Wallnau, 2010), small categories were collapsed and the 'non-applicable' and 'do not know' categories were eliminated.

Interview data analysis

Interviews were recorded and transcribed. Open and axial coding strategies were used (Babbie, 2007). Firstly, interview transcripts were read in depth to identify the key concepts contained within them. Secondly, interview statements were broken down into discrete parts and examined closely to identify relations, similarities and differences. Thirdly, conceptually similar statements were grouped and labelled under broader categories. Finally, codes were reanalysed to uncover similarities, regrouped into categories on the basis of common properties and further examined for deeper, analytical concepts. Discussion of coding procedures with a fellow researcher led to refining conceptual categories. Five general conceptual categories were created: network dynamics; characteristics of participating academics and their connections; learning processes; learning content; and the perceived value of networks.

The participants

The email invitation resulted in thirty-seven participants drawn from ten UK-based universities for the SNA survey. For the follow-up interviews 11/37 participants volunteered. Table 1 summarises participants' demographic information:

Table 1 Demographic information

| Demographics	Frequency	Percent	Cumulative Percent
Gender			
Female	21	56.8	56.8
Male	16	43.2	100.0
Age range			
20-29	1	2.7	2.7
30-39	10	27.0	29.7
40-49	14	37.8	67.6
50-59	10	27.0	94.6
60-69	1	2.7	97.3
70 and above	1	2.7	100.0
Overall work experience			
0-3 years	2	5.4	5.4
4-10 years	7	18.9	24.3
11+ years	28	75.7	100.0
Department			
Life sciences	10	27.8	27.8
Engineering	13	36.1	63.9
Business	4	11.1	75.0
Social science	9	25.0	100.0

Results

This section presents synthesised quantitative results of the SNA survey and the semi-structured interviews. The qualitative results are described in Pataraia et al (2013). Firstly, we discuss the overall form of participants' personal learning networks relating to teaching. Secondly, we examine the extent and characteristics of any homophily evident. Thirdly we examine tendencies in the participants' learning network relations. Finally, we measure the significance of association between physical proximity/strength

of tie and frequency of interaction about teaching.

The form of participants' personal learning networks relating to teaching

The survey generated network data about 37 participants' 266 learning relationships. Figure 1 outlines that the connections that participants considered key to their learning about teaching were spread across different settings, although the highest percentage was based within participants' local organisations, with departmental and institutional colleagues adding up to 56%.
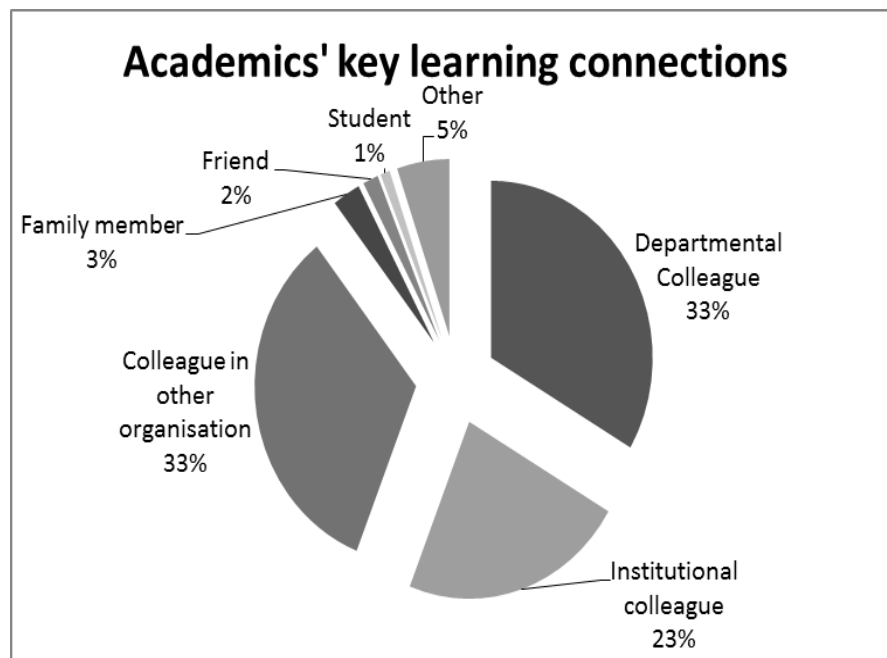
Figure 1 Distribution of academics' significant learning relationships

Interviews revealed that the majority of participants had interest-driven and task-specific learning networks. They regularly utilised network resources, such as expertise, information and guidance, to execute work-related tasks and to solve problems associated with teaching. They were strategic in establishing, sustaining and utilising learning connections. They reached out to people who they perceived as having the most useful information, sometimes for a specific enquiry but sometimes more

generally: *'Whoever I think has got the particular expertise, I will go to'* (R5), *'These are people I consider to be a useful source of useful information and good source of advice'* (R20).

Others' professional background and capacity to provide reliable information and guidance were key criteria when deciding who to reach out for. Respect for expertise, competence and relevant experience was repeatedly highlighted by all interviewees.

During interviews, 9/11 participants highlighted that a good personal relationship was a driving factor not only for establishing, but also for maintaining, learning connections: *'There tends to be a kind of friendship element to the ones who are also most useful to learn stuff from, even if it's not sort of close friends particularly, but that sense of trust or of knowing a bit more about someone just helps make things work better'* (R20). SNA survey results also revealed the prevalence of strong-tie connections: participants classified 196/266 learning connections as friends.

Participants were inclined to establish learning connections with more experienced peers (Table 2):

Table 2 Experience level of respondents and their learning connections

Respondents' Overall work experience level	Learning connections' experience level		
	0-3 years	4-10 years	11 and above
0-3 years	0.0%	6.3%	93.8%
4-10 years	1.9%	24.1%	57.4%
11 and above	2.0%	11.2%	70.9%

The majority of participants' learning networks (31/37 participants) were dominated by other academics. A mixture of academic and non-academic (from industry, business and civil service) connections relating to teaching was encountered only in the networks of participants specialising in vocational subjects, including 2/4

participants from Business, 3/3 participants from Creative Industries and 1/10 participant from Life Science.

Homophily evident in participants' networks relating to teaching

Krackhardt and Stern's (1988) E-I statistics were utilised to measure participants' tendency to establish ties with contacts from the same group or class as themselves. The homophily score was calculated by summing respondents' ties to contacts who were in a different attribute category, subtracting the number of the respondent's ties to contacts from the same attribute category and dividing by network size (Borgatti, 2006). Homophily was explored with respect to three well-established factors affecting the formation of relationships, gender, work-experience level and occupation:

HOMOPHILY - Population-Level Statistics

E-I index for EGOSEX=SEX = -0.128
E-I index for EGOWORKEXP=WORKEXP = -0.143
E-I index for EGOOCCUP=OCCUP = -0.647

The population-level statistics do not suggest a strong preference among participants for cultivating learning connections of the same gender or experience level. However, the majority of respondents (24/37 - 65%) indicated homophilious learning relationships with respect to academic profession. This tendency was the most evident in networks of the respondents specialising in Social (7/9- 78%) and Life Sciences (8/10-80%).

Network tendencies evident in participants' networks relating to teaching

Although we investigated tendencies in all six of Cross and Parker's (2004) dimensions, we present only those that were found statistically significant.

14

Relative hierarchical position

We found a significant association between participants' overall work-experience level and hierarchical status of learning connections (d.f =4, n=206, p<0.001). A diversity in the hierarchical positions of participants' contacts was clearly evident in the networks of more experienced academics (ie those who had 11 and more years of experience). Their networks consisted of contacts at all hierarchical levels. In contrast, less experienced participants, i.e. novices (3 or fewer years) and midcareer professionals (4-10 years) appeared to establish learning connections largely with those above them in the hierarchy.

Connecting with people in the home institution The analysis of the composition of participants' networks revealed a tendency for establishing learning connections within organisational boundaries (Table 3).

Table 3 Acquaintance types according to participants' gender, overall work experience level, age group and discipline

Respondents	The number of respondents	Acquaintance Type						
		Departmental Colleague	Institutional colleague	Colleague in other organisation	Family member	Friend	Student	Other
Gender								
Female	n=21	31.9%	27.6%	31.9%	3.7%	1.2%	0.0%	3.7%
Male	n=16	35.0%	17.5%	35.0%	1.9%	1.9%	1.9%	6.8%
Overall work experience level								
0-3 years	n=2	25.0%	6.3%	37.5%	0.0%	0.0%	0.0%	31.3%
4-10 years	n=7	22.2%	33.3%	37.0%	5.6%	0.0%	0.0%	1.9%
11 and above	n=28	36.7%	22.4%	31.6%	2.6%	2.0%	1.0%	3.6%
Age Group								
20-29	n=1	28.6%	0.0%	71.4%	0.0%	0.0%	0.0%	0.0%
30-39	n=10	30.4%	30.4%	24.6%	4.3%	1.4%	0.0%	8.7%
40-49	n=14	32.4%	22.5%	38.2%	2.0%	0.0%	1.0%	3.9%
50-59	n=10	34.2%	20.5%	34.2%	4.1%	2.7%	0.0%	4.1%
60-69	n=1	40.0%	60.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Respondents	The number of respondents	Acquaintance Type						
		Departmental Colleague	Institutional colleague	Colleague in other organisation	Family member	Friend	Student	Other
70 and above	n=1	50.0%	10.0%	20.0%	0.0%	10.0%	10.0%	0.0%
Discipline								
Business	n=4	33.3%	14.8%	44.4%	0.0%	3.7%	3.7%	0.0%
Engineering	n=13	27.1%	22.4%	32.9%	5.9%	1.2%	1.2%	9.4%
Life sciences	n=10	43.2%	29.6%	19.8%	2.5%	1.2%	0.0%	3.7%
Social science	n=9	26.5%	23.5%	44.1%	1.5%	1.5%	0.0%	2.9%

As illustrated in Table 3, academics specialising in Life Sciences had the highest percentage of departmental connections, appearing to be the least inclined to cultivate relationships beyond institutional boundaries.

Physical proximity

Participants' networks revealed a predominance of physically-proximate learning connections. As indicated in Table 4, the majority of learning connections were situated within participants' own organisation:

Table 4. Physical proximity of connections

	Frequency	Percent	Cumulative Percent
Same house	5	1.9	1.9
Same room	17	6.4	8.3
Same floor	55	20.7	28.9
Different floor	17	6.4	35.3
Different building	60	22.6	57.9
Same city	18	6.8	64.7
Different city	58	21.8	86.5
Different country	36	13.5	100.0
Total	266	100.0	

Length of time known

Participants' networks revealed diversity in the length of time they have known their contacts. Once again, this heterogeneity was more evident among more experienced academics (Table 5).

16

Table 5. Respondents' overall work-experience level and time that they have known their connections

Respondents' overall work experience	Time known					
	Less than 1 year	1-3 years	4-5 years	6-10 years	11+ years	Total
0-3 years	31.3%	43.8%	25.0%	.0%	.0%	100.0%
4-10 years	1.9%	40.7%	38.9%	1.9%	16.7%	100.0%
11 and above	9.4%	30.4%	18.8%	22.5%	18.8%	100.0%

The p-value from the test is 0.001 (d.f =8, n=245) showing that there is a significant association between participants' overall work experience level and the length of time they have known their connections.

Statistically significant associations between different variables

To substantiate the argument regarding the impact of physical proximity on the frequency of interaction, we measured the relationship between these two variables.

Results indicate a significant association between physical proximity of learning connections and the frequency of interaction about teaching (d.f =12, n=260, p< 0.001). Frequency of interaction was likely to decrease with physical distance. In addition to proximity, we tested the relation between strength of tie (measured by friendship) and the frequency of interaction. We found a significant relationship between the tie strength and the frequency of interaction, (d.f =3, n=265, p< 0.001). Interaction with strong-tie connections was more frequent than with weak-tie connections.

Discussion

Participants' personal learning networks relating to teaching displayed diversity in their composition. Although key learning connections were found both within and outside the home institution, the percentage of physically-proximate connections was still high. The

SNA and interview data revealed that participants' learning networks were based around both physically- and emotionally-close ties, which appeared the most homophilious with respect to occupation (academic professionals). This suggests that three factors, physical proximity, the strength of tie measured in terms of friendship, and homophily in regards to similar occupation, encouraged the creation of learning networks.

Participants demonstrated awareness of the expertise available within their networks. On the basis of their understanding and expectations, they identified an appropriate person to help them acquire relevant information and essential resources. The rationale for these choices is discussed further in Pataraia et al (2013).

Findings also revealed that participants commonly shared more than one type of relationship with their contacts. Connections were multiplex, being simultaneously described as 'professional acquaintance' and 'friend'. Through interactions, participants acquired career-related resources (professional advice, expertise), as well as friendship/emotional support, and hence shared both instrumental and expressive relationships with their contacts (Ibarra, 1993). According to Lincoln and Miller's hypothesis (1979), the availability of both types of ties should have equipped participants with improved access to information, opportunities and support.

Drawing on Cross and Parker's (2004) research, we explored tendencies in network relations in order to hypothesise their potential impact on learning. We identified similar traits in the personal learning networks relating to teaching of academics working in universities to those Cross and Parker (2004) observed for professionals working in companies. For example, the networks of the academics were biased in terms of physical proximity and connecting with people in the home institution in similar ways to the networks of professionals in companies. Despite the

widespread popularisation of technologies, participants tended to favour face-to-face encounters for their learning, which occurred largely with their institutional colleagues. However, compared to networks of professionals in companies, academics' networks were diverse in terms of hierarchical position and the length of time they had known their contacts. Building on Cross and Parker's argument (2004), diversity in relation to hierarchy and length of time people have known each other should be favourable for learning new practices, since heterogeneous connections provide both access to varied knowledge and support for implementing new practices (Lincoln & Miller, 1979). While the participants could freely discuss problems or reaffirm ideas concerning teaching with their old acquaintances, they would potentially access non-redundant information, or even have chances to establish new, useful connections, through their recent acquaintances. As for the hierarchical status of learning connections, this might reflect the relatively non-hierarchical social structures within many university departments, giving participants access to wide-ranging advice on topics from practical matters of teaching (e.g. how to deal with students' disruptive behaviour) to more overarching considerations of curriculum design. The fact that novices and midcareer professionals associated largely with those above them in the hierarchy might reflect the typical composition of the departments or institutions they work in, with relatively few staff at lower levels and more at higher – offering no option but associate mainly with those higher up the hierarchy. Given that heterogeneity in the network structure was more visible among experienced participants, we may hypothesise that their networks stand a better chance of promoting serendipitous learning and innovation.

This study moves beyond existing research on academic learning by investigating the phenomenon of learning about teaching from a network perspective. An exploratory, bottom-up approach uncovers the authentic space where learning

happens, rather than presupposing learning is embedded within established structures. Although previous studies have explored the composition of academics' networks, these networks have not been examined in relation to learning about teaching. This study, therefore, contributes to the limited educational literature in this area.

Conclusion

This investigation extends the discussion of professional learning in academia in a novel way, by taking a social network perspective. This research enriches the limited understanding of academics' networks, by revealing relationships that condition professional learning and support enhancement of teaching practice. Reflection on personal networks can potentially enable academics to determine the effectiveness of their networks by identifying expertise/knowledge gaps or mechanisms for better exploitation of available resources. A practical implication of this study would be to recognise the potential of personal networks for academics' professional learning and improvement of practice, considering informal interactions relating to teaching as an integral part of the strategy for academic development; universities and central units might provide the venue, time and opportunities for informal exchange of knowledge within/across departments, as well as between different institutions, promoting dialogues and reflections around teaching practice. One such example of staff development that promotes networking between institutions is the disciplinary commons developed by Fincher and Tenenberg (2011). Moreover, central units could raise awareness of networks, by communicating to academics the importance of open and diverse networks for broadening their knowledge base and expertise. This could be achieved by offering training on enhancing the networking skills.

While the study makes a valuable contribution to the literature, the generalisability of these findings is limited, because the sample is restricted to thirty-seven academics. Participants' characteristics and networking behaviours may not be fully representative of academics in a wider range of contexts and settings. Another limitation is that the evaluation of people's learning was limited to self-reported measures. Future research should measure a broader range of evidence. Other factors, such as disciplinary differences and institutional culture, could be critical, therefore these factors could be included in future research. This work could be further extended by examining the effects of individual academics' attributes, including age, gender, work experience level and discipline on academics' networking behaviours. The impact of national culture on the composition of learning networks would also be of interest.

In summary, this study of academics' personal learning networks has identified a prevalence of physically proximate and strong-tie connections, which could potentially inhibit learning opportunities and limit access to a diverse range of knowledge and experiences. Frequent interactions with localised connections could confine academics to parochial views established within institutional boundaries and impede their exposure to fresh perspectives, new trajectories and external expertise that are vital for teaching innovations and professional development. Finally, further research should inform targeted actions to promote connectivity within and across institutions with the potential of creating favourable conditions for effective learning.

References

Ancori, B., Bureth, A. and Cohendet, P. (2000), "The economics of knowledge: The debate about codification and tacit knowledge", *Industrial and Corporate Change,* Vol. 9 No. 2, pp. 255-287.

Babbie, E. R. (2007), *The Practice of Social Research*, Wadsworth Publishing, CA, USA.

Baker-Doyle, K. J. (2011), *The networked teacher: How new teachers fail to build social networks for professional support,* Teachers College Press, New York, NY.

Baker-Doyle, K. J. and Yoon. S.A. (2011), "In search of practitioner-based social capital: a social network analysis tool for understanding and facilitating teacher collaboration in a US-based STEM professional development program", *Professional Development in Education*, Vol. 37 No. 1, pp. 75-93.

Borgatti, S. P. and Cross. R. (2003), "A relational view of information seeking and learning in social networks", *Management Science*, Vol. 49 No.4, pp. 432-445.

Borgatti, S.P. (2006). E-Network Software for Ego-Network Analysis. Analytic Technologies: Lexington, KY

Burt, R. S. (1995), *Structural holes: The social structure of competition*, Harvard University Press.

Campbell, K.E. and Lee, B.A. (1991), "Name generators in surveys of personal networks"*, Social Networks*, Vol. 13 No. 3.

Carrington, P. J. and Scott. J. (2011), *The SAGE handbook of social network analysis*, SAGE.

Granovetter, M. S. (1973), "The Strength of Weak Ties". *American Journal of Sociology*, Vol. 78 No. 6, 1360–1380.

Cross, R., Borgatti, S.P. and Parker. A. (2001), "Beyond Answers: Dimensions of the Advice Network", *Social Networks*, Vo. 23 No. 3, pp. 215-235.

Cross, R. and Parker, A. (2004), *The hidden power of social networks: understanding how work really gets done in organizations*, Harvard Business School Press.

Eraut, M. (2007), "Learning from other people in the workplace", *Oxford Review of Education*, Vol 33 No. 4, pp. 403-422.

Fincher, S., and Tenenberg, J. *A Commons Leader's Vade Mecum (or, How to Instantiate a Disciplinary Commons)*, University of Kent Press, 2011.

Gersick, C. J. G., J. M. Bartunek, & J. E. Dutton. 2000. "Learning from academia: The importance of relationships in professional life", *Academy of Management Journal* Vol. 43 No. 6, pp. 1026-1044.

Gravetter, F. J. and Wallnau, L. B. (2010), *Essentials of Statistics for the Behavioural Science*, Wadworth International Edition.

Haines, V. A., Hurlbert, J.S. and Beggs, J.J. (1996), "Exploring the determinants of support provision: Provider characteristics, personal networks, community contexts, and support following life events", *Journal of Health and Social Behaviour*, Vol. 37 No. 3, pp. 252-264.

Hinds, P.J., Carley, K. M., Krackhardt, D. and Wholey, D. (2000). "Choosing work group members: Balancing similarity, competence, and familiarity", *Organizational Behaviour and Human Decision Processes*, Vol. 81 No. 2, pp. 226–251.

Ibarra, H. (1993), "Personal networks of women and minorities in management: A conceptual framework", *Academy of Management. The Academy of Management Review,* Vol. 18 No. 1, pp. 56.

Kadushin, C. (2011), *Understanding Social Networks: Theories, concepts, and findings*, Oxford University Press, USA.

Kerr, D., Aiston, S., White, K., Holland, M. and Grayson, H. (2003). "Review of networked learning communities", National Foundation for Educational Research, Maidenhead, UK.

Knoke, D. and Yang, S. (2007), *Social Network Analysis*, SAGE Publications.

Kuzel, A. J. (1992), "Sampling in qualitative inquiry", in Benjamin, F. and Miller, W. L (Ed.), *Doing Qualitative Research Crabtree, Research Methods for Primary Care*, Sage Publications, Inc, Thousand Oaks, CA, US, Vol. 3, pp. 31-44.

Lieberman, A. and Miller, L. (1999), *Teachers-transforming Their World and Their Work*, Teachers College Press.

Lieberman, A. and Wood, D. R. (2003), *Inside the National Writing Project: Connecting Network Learning and Classroom Teaching*, Teachers College Press.

Lima, J.Á. (2008), "Thinking more deeply about networks in education", *Journal of Educational Change,* Vol. 11 No. 1, pp. 1-21.

Lincoln, J. R. and Miller, J. (1979), "Work and friendship ties in organizations: A comparative analysis of relation networks", *Administrative Science Quarterly,* Vol. 24 No. 2, pp. 181-199.

Marsden, P.V (1988), "Homogeneity in confiding relations", *Social Networks*, Vol. 10 No. 1, pp. 57-76.

Marsden, P. V. and Campbell. K. E. (2005), "Reflections on conceptualizing and measuring tie strength", *Social Forces*, Vol. 91 No. 1, pp. 17-23.

McCormick, R., Fox, A., Carmichael, P. and Procter, R. (2011), *Researching and Understanding Educational Networks*, Routledge, Oxon.

McPherson, M., Smith-Lovin, L. and Cook, J.M. (2001), "Birds of a feather: Homophily in social networks", *Annual Review of Sociology*, Vol. 27, pp. 415-444.

Pallant, J. (2010), *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS,* Open University Press, 4th ed, England.

Pataraia, N., Margaryan, A., Falconer, I., & Littlejohn, A. (2013). "How and what do academics learn through their personal networks". *Journal of Further and Higher Education*. DOI: 10.1080/0309877X.2013.831041.

Reagans, R. and McEvily, B. (2003). "Network structure and knowledge transfer: The effects of cohesion and range". *Administrative Science Quarterly*, Vol. 48, pp. 240–267.

Scardamalia, M. and Bereiter, C. (2003), "Knowledge building", in Guthrie, J. W. (Ed.), *Encyclopedia of Education*, 2nd edition, Macmillan Reference, New York, USA.

Schulz, K. P. and Geithner, S. (2010). "Between exchange and development: organizational learning in schools through inter-organizational networks", *Learning Organization*, Vol. 17 No. 2, pp. 69–85.

Tobin, D. R. (1998), "Building Your Personal Learning Network", available at: http://www.tobincls.com/learningnetwork.htm / (accessed 28 February 2013).

Tynjälä, P. (2008), "Perspective into learning in the workplace", *Educational Research Review* Vol. 3, pp. 130-154.

Way, J. (2012), "Developing a personal learning network for fast and free professional learning", *Access 26,* No1, pp. 16–19.

Word count: 6001