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Driving Change Through Brokering Practices In An Online Community Ecosystem

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DRIVING CHANGE THROUGH BROKERING PRACTICES IN AN ONLINE COMMUNITY ECOSYSTEM

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Abstract

This study investigated how online communities helped drive change in a three-year professional development programme for New Zealand teachers. The programme aimed to embed effective ICT-based teaching practices in schools, together with a student-centred approach that positioned the teacher's role as a facilitator of learning.

An unofficial blogging community, connecting three cluster-based online communities to a global network, was found to play a role in driving embedding of the new approach. Influential individuals from this community (connector-leaders) employed a set of brokering practices, making differentiated use of technologies to foster knowledge embedding via five processes: focusing, persuading, aligning, adapting and owning. Their influence was extended by the activities of a group of followers who brokered knowledge across the online/offline boundary.

The study identifies the workings of a socio-technological system in which change was promoted through brokering practices and sophisticated use of technology. It suggests that when system-level change is the goal, managers should consider the value of brokering roles and normative social processes that help to embed and sustain change. The activities of this system can be seen as supporting both the empirical-rational and the normative-re-educative approach to change (Chin and Benne, 1969).

Keywords: knowledge embedding, knowledge broker, professional change, online communities, socio-technological system, normative processes

1 INTRODUCTION

The study was motivated by a lack of understanding of how online communities promoted the deep transfer, or embedding of professional knowledge. It aimed to understand how professional knowledge is embedded (contextualised and integrated into interpretive frameworks and work practices) in an online community setting, and to identify the technologies, roles, and other factors that contribute to knowledge transfer and embedding. The study context was a 3-year professional development programme for New Zealand schools which had a change focus. It involved introducing teachers to ICT-based practice while shifting towards a more constructivist, student-centred approach. This challenged prevailing norms and the values and beliefs of many participants. The embedding of knowledge associated with this new approach therefore required a corresponding change in values and beliefs.

The paper begins with literature review, outlining what is known about the nature of professional knowledge, the barriers it presents to change, and the role of online communities in supporting knowledge transfer and deeper knowledge embedding. This is followed by an overview of the research method and then the presentation of key findings. The paper concludes by considering the study's implications for practice and future research.

2 LITERATURE REVIEW

Knowledge has been described as *"a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information"* (Davenport and Prusak, 1998, p. 5). Professional knowledge is a mixture of profession-specific understandings, practices and values used by members of a profession (e.g., engineering, nursing, teaching) to perform and think about their work. At an individual level, this knowledge is strongly activity-oriented, contextualised and personalised (Borko and Putnam, 1996, Connelly and Clandinin, 1985). In the case of teachers, professional knowledge is deeply embedded in individuals' interpretive frameworks, belief structures, work routines and practices (Richardson and Placier, 2001). Researchers have identified diverse constructs to emphasise its rich, personal and contextual nature (e.g., *personal practical knowledge* (Connelly and Clandinin, 1985), *images* (Calderhead, 1988), *knowledge in action* (Schön, 1983), *situated knowledge* (Leinhardt, 1988), and *event-structured knowledge* (Carter and Doyle, 1987). Borko and Putman (1996) argue that, "*what teachers know and believe is completely intertwined, both among domains and within actions and context"* (p.677). Like a vine growing on a tree, this intertwined structure gains strength and rigidity over time, becoming more stable in nature (Bennett, 1992).

It is periodically necessary to undertake professional change, in order to keep practice current, reflect changing governmental, environmental, and societal concerns, and respond to new understandings. However, the entangled nature of professional knowledge and beliefs is a significant barrier to such change: pre-existing embedded meaning structures can limit one's response to new information, leading to rejection of new ideas and practices that do not readily fit with the existing schema (Richardson and Placier, 2001). New practices must, therefore, be underpinned by compatible interpretive frameworks and beliefs in order to become embedded in a sustainable way (Handal, 2004, Richardson and Placier, 2001). For example, teachers' use of IT in classrooms is seen as providing flexible opportunities for student learning, provided that teachers view knowledge as arising primarily from the learning process, rather than seeing it as a transmitted product. According to Handal (2004), *"it is indispensable that teachers' instructional beliefs match principles underlying current constructivist reform…so the effective educational change can take place (p.1)."*

With the increasing uptake of online communication tools by organisations, various authors have promoted online communities and networks as a suitable means for facilitating knowledge transfer among professionals who have a changing knowledge base (e.g., Hargreaves, 2003; Hew and Hara, 2007; Wagner and Bolloju, 2005). Although knowledge transfer is known to occur in distributed online settings and antecedents of knowledge sharing have been identified (e.g., Sarker et. al, 2005; Zhang and Watts, 2003), there is limited understanding of how online settings might foster deeper knowledge transfer. Studies of online communities and networks typically emphasise knowledge sharing, with the implicit view that knowledge transfer is a transmission-based process. However, a transmission-based view is too simplistic to account for knowledge embedding.

As knowledge becomes embedded it is known to become strongly contextualised (personalised localised, and/or customised) and integrated with other knowledge, processes, practices, routines and norms (Argote et al., 2003; Davenport and Prusak, 1998). In colloquial terms, it has stuck, or is sticky (Szulanski, 1996, Hippel, 1991). By facilitating convergence in the interpretive frameworks of employees, the embedding of knowledge also fosters organisational alignment (Sanchez, 20005). In the research literature, there are differing account of how knowledge embedding occurs. *Knowledge transfer* studies typically portray transfer as a stage-based process (Boisot 1998; Kwan and Cheung 2006; Szulanski 1996), in which embedding (or an analogous construct) occurs at the final stage(s). On the other hand, accounts of *knowledge creation* cast the embedding of knowledge as a continual process that builds *knowledge* (Nonaka and Takaeuchi, 1995), ways of *knowing* (Orlikowski, 2002), or *organisational learning* (Argyris and Schön 1978, 1996; Sanchez 2005). These studies emphasise the importance of day-to-day socialisation in gradually transforming and aligning employee knowledge. The above, apparently divergent, views can be seen as complementary perspectives. Whereas the stage-based view of knowledge embedding provides a high level framework for managing change, the continual process view highlights the gradual changes in knowledge that can be fostered through organisational culture and interactions. In combination, these views emphasise the complexity of the embedding process, its reliance on various sub-processes, and its fundamentally social nature.

While much research into online communities focuses on knowledge sharing, an emerging stream of work is highlighting the normative potential of online networks. For example, Wei (2004) identifies how communication practices helped build norms in a blog-based knitting community, while Steiny (2009) highlights the predictive influence of structure and roles in social networks on users and their behaviours. This research is of potential relevance to the view of knowledge embedding as an ongoing, normative process.

In summary, our review of the literature revealed a lack of mature understanding of how knowledge transfer and embedding might be fostered in an online community setting. Our research aimed to help address this gap and to develop relevant explanatory theory (Gregor, 2006). It was guided by the question: *How do online communities of practice (CoPs) facilitate the transfer and embedding of professional knowledge?* and the subsidiary questions, (a) *what technologies, roles, and other factors help online CoPs to embed knowledge?* and (b) *what is the nature of the knowledge embedding process in online CoPs?*

3 RESEARCH SETTING AND METHOD

New Zealand's school system provided a context in which the research question was strongly topical: The government had embarked on a strategy of embedding knowledge about effective, student-centred teaching through ICT, with the goal of improving system-level teaching quality and the equity of student education, while leveraging a significant investment in ICT infrastructure. Its e-learning strategy (Ministry of Education, 2006) looked to professional communities, and online communities and networks, to help achieve this.

The study used qualitative methods within the interpretivist tradition. We employed a case research method (Yin, 2003), as is considered appropriate when aiming to generate explanatory theory (Gregor, 2006) and tackling a *how* question in an area about which little is known, in a real-world setting (Yin, ibid). The case was a national, three-year ICT professional development programme for New Zealand schools. It initially included four subunits: online communities (A,B,C and D) based in regional clusters of schools where embedding of the new teaching approach was seen by stakeholders as having been successful.

We conducted semi-structured interviews with 41 members of these communities: lead teachers (school-based change agents), teachers, school principals/deputy principals, cluster facilitators, a national facilitator and the project leader. We conducted two rounds of interviews, refining questions as preliminary themes began to emerge. (To verify that embedding of the new approach had occurred, we analysed the correspondence between the government's top-down themes and the bottom-up reports of participants relating to their beliefs, values and practices.) During fieldwork, it emerged that Community D's online community had become inactive. Of more significance, we found that key individuals from communities A, B and C belonged to a highly active, unofficial online community of bloggers that played an influential role (Community E). In order to better understand the role of this community, we interviewed four additional members, bringing the total number of participant interviews to 45. The overlapping membership between communities allowed us to gain a system-level view of the case.

We took an inductive approach to theory generation because we were tackling an unexplored area, the research setting was unique, and the intent was explanatory and descriptive; fitting most of Huberman and Miles's suitability criteria for the use of induction (1998, p.185). We coded the data using text analysis (Cresswell, 2003) via nVivo software. In parallel with the interviews, we analysed data from online records, including instant messaging (Skype and ichat) transcripts, and content from blogs, forums, Delicious and Twitter. A large set of emergent codes was gradually reduced, and bridging and theoretical codes were created as key categories, relationships and trends emerged. Our approach to ensuring *trustworthiness* (Lincoln and Guba, 1985) included running members checks, documenting the recursive nature of data gathering and analysis, triangulating data sources, and creating an audit trail. The preliminary results were validated at a participant workshop and using an anonymous wiki for feedback.

4 RESULTS

The case comprised a system of overlapping communities, or online community of practice ecosystem (Castro, 2004). Community E functioned as a hub and brokering layer in this system. It was an unofficial, distributed, and highly active, and passionate, community of practice whose core members were converts to the ICT-based, student-centred teaching approach *(the new way)*. They believed in the transformative power of ICT when used to support constructivist learning, and made constant use of a wide range of communication technologies including blogs, instant messaging (Skype and i-chat), Twitter, Delicious, RSS feeds, and Teacher Tube videos, to sustain their beliefs, enrich their professional understandings, and promote and broker knowledge. Community E operated as a bridging community through which the new knowledge (values, beliefs and practices associated with *the new way*) was brokered. Although the active cluster-based online communities (A, B and C) were interconnected via a national website, listserv and forums, they were more strongly connected, in terms of interaction and influence, via the overlapping membership with Community E. All three active cluster-based communities had overlapping membership with community E. The overlaps occurred in visible zone within which core members interacted with a publicly visible online presence, and a peripheral invisible zone within which their followers interacted invisibly, via IM, email and phone; and face-to-face, with the core members. Although invisible in community E, these followers had a visible role in their

closed, cluster-based online communities. They fed the knowledge they gained through their participation in community E to their cluster-based peers using both online and offline means.

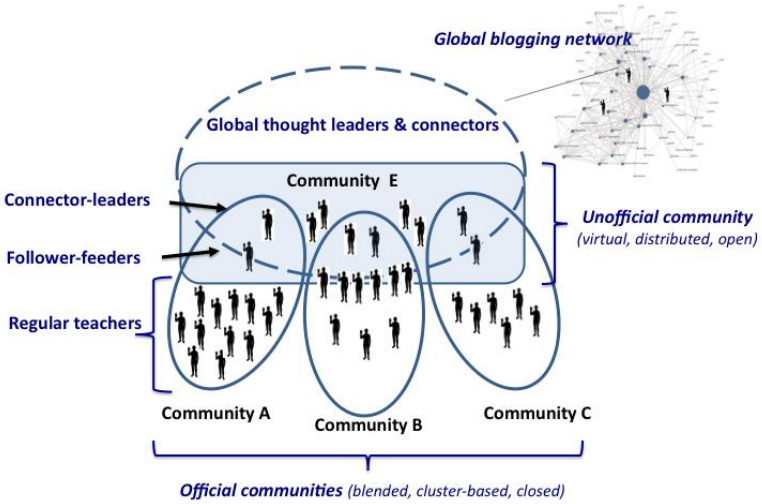

Figure 1. System of communities showing overlapping structure and participant roles

Figure 1 illustrates how Community E formed both a horizontal brokering layer (connecting the cluster-based online communities to which its members belonged) and a vertical brokering layer, overlapping with both the cluster-based communities and a global *edublogging* network. Four kinds of roles were identified: regular teachers, follower-feeders, connector-leaders and global thought leaders. (Analysis of blog linkages revealed a group of overseas bloggers with strong, multiple ties to Community E.)

4.1 Knowledge Broker Roles: the Connector-leader and Follower-feeder

Knowledge brokering was performed by members of Community E who played two complementary roles: visible *connector-leaders* and invisible *follower-feeders*. *Connector-leaders* were respected, well-connected educators who shared a belief in the potential of ICT for enhancing learning if used in a student-centric way. They had a high level of online visibility, authoring blogs and commenting on the blogs of others. (They also interacted less visibly using IM, Twitter and e-mail.) Although based in regional communities, they identified most strongly with the distributed community. *Follower-feeders* were invisible followers in the blogging community. Within their cluster communities they participated in closed online forums and IM discussions. However, they spent considerably more time engaging with their own followers – regular teachers – in face-to-face settings where they passed on knowledge. They can therefore be seen as spanning an online-offline boundary.

In the following section we report on five key knowledge embedding processes that were found to promote embedding, and outline a series of practices undertaken by connector-leaders that promoted these embedding processes.

4.2 Knowledge-embedding Processes

Analysis of data revealed five fundamental processes that had promoted the embedding of the new knowledge in the communities studied. These were *focusing*, *persuading*, *aligning*, *adapting*, and *owning* (developing ownership)[1].

[1] This was part of a larger study in which mechanisms at three different levels (macro, meso, and micro) were found to promote the five embedding processes. This paper examines the macro, or system-level facilitators of embedding.

- ***Focusing*** is defined as having a focus on a specific approach or issue (e.g., a learning model, teaching method, or use of technology) associated with *the new way*. Focusing promoted knowledge embedding of the new way by encouraging continuity of attention and economy of energy.
- ***Persuading*** involved being persuaded and/or persuading oneself/others of the benefit of *the new way* and its superiority, so as to non-coercively change attitudes and/or behaviour. It promoted embedding of new knowledge by encouraging ways of thinking that were in tune with the emerging paradigm of ICT-based, student centred teaching (the new way)
- ***Aligning*** involved (a) aligning emerging norms (practices, experiences, interpretive frameworks, values and beliefs) with those of peers and the community, through comparison and adjustment, and (b) aligning one's practice with theory that supported the new paradigm. This promoted embedding of new norms, theories and practices associated with the new way.
- ***Adapting*** involved (a) adapting and modifying established practice, ways of thinking (interpretive frameworks) and values to accommodate emerging beliefs and norms, (b) adapting new approaches (models and methods), and (c) adapting communication norms to a community-based approach. Adapting was a necessary adjunct of aligning.
- ***Owning*** involved developing ownership of new knowledge and associated interpretive frameworks, practices, beliefs and values at the individual, school and/or community level. It promoted embedding by personalisation and customisation of the new way.

Our analysis of the data revealed a variety of means through which these five fundamental embedding processes were facilitated through online communities at individual, organisational and system levels. This paper reports on how the embedding processes were fostered at the whole-of-system (cross-community) level. A set of sophisticated brokering practices, which had evolved over time, was performed by the *connector-leaders*. These practices, combined with highly specialised uses of technologies, strongly promoted the knowledge embedding processes. Together with the secondary brokering activities of follower-feeders, this contributed powerfully to the embedding of knowledge (values, beliefs, understandings and practices) across the cluster-based communities. The brokering practices were deeply bound up with the culture of the blogging community which had emerged over a three-year period. The practices and associated uses of technology are outlined below, and detailed in a series of tables.

4.3 Knowledge Brokering Practices of Connector-leaders

4.3.1 Filtering and Focusing

Connector-leaders selected foci to guide their online engagement, such as learning models, favourite theories, or ways of using technology that supported *the new way*. They used these foci to screen and filter the large quantity of online content being produced daily, and to guide their own blog postings.

> *It's just getting an understanding of the way other people think, and seeing that there's …parts of what they're saying that fit with what I'm thinking, and what I believe.*

The job of filtering external blog content was in part devolved to trusted global edubloggers:

> *There's about five people… I'll subscribe to the RSS feed in my Bloglines, and so I see everything that they stick on their Del.ici.ous ....it's getting other people to do the work for you… I use other people as a filter.*

This was followed by a manual appraisal of quality – described by one person as being like triage. Once they had identified suitable content, they tagged selected content with local community themes (e.g. inquiry) for their followers. Doing this created significant value:

> *It's like going to the library, and rather than searching for your own good books, some nice librarian (comes up)…and says, "Here are fifteen books you might well be interested in"…these guys have filtered out a whole lot of good stuff, and so I can focus on reading and thinking about it. (Follower-feeder)*

Table 1 details the filtering and focusing practices of *connector-leaders* and the technologies used to facilitate them.

Practice	**Technologies**	**Explanation**
Establishing foci: Selecting guiding/framing foci	RSS feeds	Aids *focusing;* reduces noise of web content
Scanning, screening and filtering*:* Scanning content using foci to screen and filter	RSS feeds	Enhances *focusing* by aggregating content on relevant themes
Following: Following respected, influential people and/or colleagues	Tagging/RSS feeds, email, Twitter, Skype/ iChat	Facilitates *aligning* of ideas*;* Topical shifts in themes keep ideas fresh and relevant (re-*focusing*)
Filtering for quality *("triage"):* Screening material for relevance and quality	Manual decision-making supported by Skype / iChat peer review	Ensures attention is given to quality, relevant material; condenses inputs (*focusing*)
Sorting and classifying*:* Sorting and classifying content into familiar categories (community taxonomy)	Social bookmarking (Del.icio.us)	Content is contextualised using categories relevant to community, promoting *focusing* and *aligning* (thematic convergence)

Table 1. Filtering and Focusing Practices of Connector-leaders

4.3.2 Reinforcing and Contextualising

Having identified relevant, quality material, *connector-leaders* recommended, reinforced and recycled the incoming themes on their blogs. They increased the relevance and/or novelty of content to followers by extending themes, adding contextual commentary, juxtaposing and recombining ideas, challenging followers, and putting a new spin on a familiar theme. These practices combined the power of redundancy (repetition) of messages with the benefit of novelty. Repackaging and localising familiar ideas increased relevance, while underlining and enriching key themes:

> *I've taken this bit from one person, this bit from someone else, and packaged it up differently. (Connector-leader)*

Adding an original perspective to a thought leader's content created reciprocal benefits. It conferred authority by association on the citing author, and expanded the influence and blog ratings of the originator. The practice of tagging such postings with the cited authors' names (to enable discovery via RSS feeds) sometimes led to reciprocal commenting, setting up a virtuous cycle, and sustaining conversation on major themes. Stirring things up was a practice that highlighted tension between existing practices and the new way. This facilitated persuading by creating cognitive dissonance that encouraged teachers to engage deeply with the new ideas and values. This is an example of the direct route of persuasion (Oinas-Kukkonen and Harjumaa, 2009). Exposing inconsistency is also known to help motivate attitude change (Oinas-Kukkonen, 2010; Simmons et al., 2001). The reinforcing and contextualising amplified themes while promoting owning of knowledge at the local level. The reinforcing and contextualising practices and the technologies used are shown in table 2.

Practice	Technologies	Explanation
Promoting: Citing or recommending a blog post or presentation by another person	Blogs, Online Videos, Tagging, RSS Feeds	Amplifies significance of message; drives followers to source (*persuading* others while *aligning* with source)
Extending: Using someone else's (referenced) blog post as a springboard for one's own thoughts (also described as *piggybacking*)	Blogs, Online Videos, Tagging, RSS Feeds	Adds local value and relevance by contextualising content. Reinforces by adding weight of local author, who gains further credibility through association with the cited material/author (*persuading; aligning*)
Stirring up: As above, but disagreeing with a referenced source	Blogs, Online Videos, Tagging, RSS Feeds	As above, but may trigger deeper engagement of readers with concepts as they are challenged by cognitive dissonance to take/justify a stance (promotes stronger *focusing*)
Tagging: Tagging referenced material with the originator's name	Blogs, Tagging, RSS feeds, e-mail	Alerts the originator to a new, relevant posting (*focusing* and *aligning*). This may lead to the author responding, generating further authority & impact (*persuading*), and deepening the conversation.
Commentating in a group: Commentating on a blog or conference keynote to contextualise it, adding local/personal opinion	Twitter, Skype/iChat	Contextualises a real-time presentation, promoting a shared interpretation (*focusing, aligning*)
Remixing: Juxtaposing content from different sources to make a point; giving a new 'spin'	Blogs, Tagging, RSS feeds	Novelty helps gain attention and can generate new insights. May promote *persuading.*
Echoing/resonating: Writing a blog post that resonates with previously introduced themes (without referencing 'source')	Blogs, Tagging, RSS feeds	Recycling familiar themes from a new angle (*aligning*) reinforces concepts. Lack of citation suggests *owning* of concepts.

Table 2. Reinforcing and Contextualising Practices of Connector-leaders

4.3.3 Feeding and Helping Others

Connector-leaders were strongly aware of the needs of their local followers, going to considerable lengths to 'feed' them. This extended beyond posting blog content, to tagging and bookmarking material, and e-mailing followers the URL links to blog posts. This customised service helped teachers work out their next steps and resulted in discussions via e-mail, phone conversation and/or face-to-face. The *connector-leaders* also provided a voluntary just-in-time support service for each other and their followers, facilitating the process of adapting. This service helped to build social capital, binding them to the community and creating a spirit of reciprocity. It was made possible by a culture of staying online for long periods. Competence with technology was essential for the successful embedding of *the new way*, so assisting each other with technical issues was important. IM and Twitter were tools of choice for seeking/providing assistance. They also provided a practical matchmaking service, linking schools to external individuals with relevant specialist (teaching or technical) knowledge. They supported other *connector-leaders* who sought suitable quotes for their blog posts, feedback on emerging ideas, and input into communal resources, such as voice-threads. (Drawing together of complementary perspectives in communally developed resources served to mutually reinforce a core set of beliefs – persuading and aligning – and promote perseverance.) Real-time collaboration was also used to affirm successes, providing reassurance about the direction of change. Table 3 shows the practices and facilitating technologies used for feeding and helping others.

Practice	Technologies	Explanation
Feeding		
Matching: Matching incoming online (blog) content to known needs of clusters and individuals	e-mail	Ensures delivery of relevant content, aiding ability of recipient to interpret, embed and enact new knowledge
Passive feeding: Tagging content so it can be accessed by others (see also *Sorting and Classifying* above)	Tagging, RSS feeds	Results in feeding of followers who use RSS feeds and bookmarks; promotes *focusing*
Active feeding: Alerting individuals who have limited online time to specific relevant blog/online content	e-mail, Skype/iChat, Twitter	Personalising content, combined with individual attention, builds relevance and *owning*; sustains *focusing*
Helping others		
Being available: Community culture involves long periods of being continuously available online	Twitter, Skype/iChat	Mutual facilitation of just-in-time support service supports *adapting* and promotes *aligning*
Sharing successes and problems: Sharing and celebrating success	Twitter, Skype/iChat	A form of *persuading* that sustains beliefs and commitment
Testing and benchmarking: Testing out ideas with colleagues, making comparisons about ideas implemented in different contexts	Twitter, Skype/iChat	Practical support for embedding as ideas and practices evolve; promotes *aligning*
Brokering connections and solutions: Brokering connections between local community members and technology or educational experts/practitioners	Twitter, Skype/iChat, e-mail	Practical support for followers as they implement new processes and technologies (*adapting)*
Defending the community: Defending community members who are under attack, using supportive comments/arguments	Blog, Twitter, Skype/IM	Reinforces community beliefs and asserts *aligning*. Bolsters individual morale by defending against non-aligned views

Table 3. Feeding and Helping Others - Practices of Connector-leaders

Sometimes helping others involved defending the community. At times, change agents were challenged by those who disagreed with the new way. Connector-leaders reported on such episodes in their blogs, summarising the comments of the attacker. Challenges posed a threat to the community's core values, invoking a powerful community reaction, like the triggering of the human immune response by an antigen. In one case, a blog post reporting an overt challenge drew eight defensive responses with a combined total of over 2,500 words. Defending against challenges reasserted the community's beliefs and values, invoking fresh rounds of persuasion, while supporting the person who had been attacked. Nonetheless, being challenged was valued as a way of safeguarding against "blog evangelism".

> *[That person was] challenging us…to justify why we think what we're thinking. That's good…that's the only way that we move forward, and solidify our position… We share similar ideas and beliefs, which encourages one another… but we are also in danger of becoming… self-congratulatory nodding dogs.*

4.4 Knowledge Brokering Practices of Follower-feeders

Follower-feeders followed the blogs of only a few *connector-leaders*, but communicated behind the scenes with these people, using email and instant messaging (IM) tools as invisible backchannels to follow-up blog posts and seek opinions and advice. (They did not use RSS feeds to keep track of the blogosphere, relying instead on personal recommendations and bookmarked URLs.) *Follower-feeders* saw themselves as feeding on the ideas of those whom they perceived as being 'above' them, and then feeding this knowledge on to those below them, as they adapted and recycled themes in new contexts:

> *I rely on Rebecca. She spends hours and hours looking at blogs on the net. She finds anything that's worthwhile, and she'll alert you to it… I'm a bit like a parasite. I take up her ideas, and I'm not confident enough to give things*

> *back. But I am passing it on to people below me. There are…people feeding off me, who will never go on-line so I have to go out seeking more to give to them.*

This feeding language is suggestive of a multi-layered food chain in which food (knowledge) is reused and digested by successive levels of consumers. In this recycling system, knowledge gained value as it was varied, amplified, and enriched by knowledge brokers. This increased in system-level alignment of thinking through redundancy and saturation of powerful themes:

> *It seems to me that there were a lot of things coming at once…. there were a lot of things out there …about inquiry learning, and those sort of philosophical shifts. And you sort of just read stuff. But it was major, and through communication with the other schools that were involved in it, we started to change the way we'd done things here, and basically threw out our curriculum plan…and started again.*

The *follower-feeders* helped to extend the reach of *connector-leaders'* knowledge by transferring and embedding knowledge in the face-to-face workplace community. Their role brokering knowledge across the online-offline boundary was invaluable because there were multiple barriers to online community engagement in the day-to-day working environment of the regular teacher. Regular teachers relied on them to interpret, adapt, and pass on the ideas of the connector-leaders and to find solutions. One *follower-feeder* described how they screened ideas with the needs of the regular teacher in mind[2]:

> *I check things out prior to telling staff. I guess I make decisions about what will work, and what not to tell them… (Follower-feeder, CoP B)*

5 CONCLUSION AND IMPLICATIONS

This study uncovered the workings of a complex, self-emergent socio-technological system – a group of online communities with overlapping membership, in which an unofficial yet influential community of bloggers functioned as a brokering layer. Two tiers of knowledge brokers in this middle-layer community – *connector-leaders* and *follower-feeder*s – performed roles that helped drive the embedding of new professional knowledge (a combination of beliefs, values, understandings and practices) through the system over a three-year period. Embedding of the new approach was fostered by a set of sophisticated brokering practices, facilitated by targeted use of diverse technologies, that drove five embedding processes – *focusing*, *persuading*, *aligning*, *adapting* and *owning*. These processes, in combination, moved beyond supporting initial persuasion to help sustain commitment, build alignment and foster ownership in the course of medium-term change and adaptation. Overtime, the recycling and reinforcing of dominant themes, combined with the alignment of community norms, fostered system-level convergence.

Steiny (2009) has noted the value of understanding structural location in social networks as a predictor of influence. This study can be seen as complementing this work by demonstrating the complex ways in which boundary-spanners utilise technology to realise this influence. The practices of connector-leaders derived from cultural evolution, rather than being an inherent result of their location in the network per se. In planning for managed persuasive systems, an understanding of the richness of human practices can be seen as providing value.

The *connector-leaders* used diverse online means to transfer knowledge to, and influence, *follower-feeders*. These people, in turn, transferred knowledge to, and influenced, their workplace followers. While *connector-leaders* played a key role as brokers in the visible online realm, their influence was extended and amplified by the activities of *follower-feeders* who crossed the online-offline boundary. These secondary boundary-spanners were critical to system-level change, and the discovery of their invisible behind-the-scenes activities (using

[2] We discuss the role of the follower-feeder in more detail, in relationship to the *lurker* themer, in another paper.

IM and e-mail as side-channels) challenges the simplistic notion of the lurker. Likewise, the discovery of their role in transferring knowledge across the online-offline boundary is significant: Knowledge transfer has traditionally been associated with boundary-crossing, yet the invisibility of the online-offline boundary, and the associated cross-boundary activity, together with a tendency to focus on online systems as stand-alone channels, could lead to the potential value of such activity being overlooked by system designers.

The invisibility of the *follower-feeder* role can be seen as a potential barrier to gaining stakeholder support for online community initiatives. In this study, there was poor recognition of the nature and value of the *connector-leader* role. Some principals portrayed these people as likeable eccentrics, whose long hours of extramural online activity had little relevance to the regular teacher. Upon reflection, this is unsurprising: The value of *connector-leaders* could only be seen when the role of *follower-feeders* was taken into account, yet the invisibility of *follower-feeders*' interactions with *connector-leaders* made this value impossible to recognise. Furthermore, schools have no responsibility for system-level change and traditional staffing structures do not support such roles. Taking a system perspective is undoubtedly difficult for those inside the system, but failure to do so could lead to the kind of problem that occurs if a key species is removed from a functioning ecology. It is unclear how best to support broker roles, but if online communities are to play a meaningful part in promoting system-level change, existing staffing models and ways of recognising value will need to be replaced with new models and means of recognising the value of brokering activities.

Knowledge transfer studies typically adopt a diffusion perspective. By focusing specifically on the process of embedding (deep transfer) and by using Davenport and Prusak's (1998) rich view of knowledge, this study has highlighted the importance of normative processes in knowledge transfer exercises where change is required. Online communities appear well-suited for supporting change strategies that take either an *empirical-rational* and/or *normative-re-educative* approach (Chin and Benne, 1969), or that combine the two, as in this case: The *empirical-rational* (ER) approach is the direct route that drives change through understanding and reasoning. It relies on convincing people of the value of change. The communities in this study facilitated ER change by promoting focusing on change-related themes, facilitating persuading and fostering owning of an emerging paradigm. The *normative-re-educative* (NR) approach is based on accomplishing change through cultural and social means. It aims to establish new norms and values and foster commitment to these. The online communities in this study supported NR change by helping establish new communication norms, facilitating persuading, promoting the aligning of interpretive frameworks and beliefs amongst individuals, and facilitating a culture of just-in-time professional support

As with any case study, these findings are contextual, so cannot be uncritically generalised or applied to other contexts. However, this limitation may be at least partly compensated for by the richness of understanding and insights that an interpretive case can generate. It is hoped that the discovery of brokering roles and practices in the study, and the resulting understanding of the way in which they were combined with technologies to facilitate embedding, may provide insights to those planning the application of online communities in situations of change. The study suggests there may be potential to use online communities as a socio-technological tool to help drive change – not merely to promote the acquisition of procedural methods, but to foster a deeper change in the way in which professionals conceive of their role and its source of value, and to promote convergence and realignment of community norms. Future studies should further explore the potential of online communities and networks to support such change and the implications of this for management, research and the design of socio-technological systems.

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