

HAR04257

Teachers' New Roles in School-based Communities of Practice

Elizabeth Hartnell-Young
The University of Melbourne
e.hartnell@unimelb.edu.au

Abstract

School classrooms can be conceptualised as bounded communities of practice made up of teachers and students working together to learn and build knowledge. The widespread use of information and communication technologies enables these communities to create knowledge, cross boundaries and build up intellectual capital. This paper, based on a qualitative study of thirty-two teachers in Victorian state schools, offers a model of four teachers' roles that reflects the current situation, and suggests ways in which these roles might be developed to enhance knowledge building. It argues that safe, knowledgeable communities within boundaries, together with active boundary-crossing, can provide the conditions for knowledge building at classroom, school and system levels.

Introduction

Schools and schooling are defined by numerous boundaries and structures that can enhance identity while circumscribing the work of teachers and students in time and space: classroom walls, school fences, timetables, curriculum frameworks and disciplines of learning. Roles and relationships constitute yet more boundaries, often between teachers and students, and between principals and teachers. In many cases too, a very strong boundary exists between primary and secondary schools in terms of location, culture and curriculum. Some suggest that existing structures and boundaries constrain teachers and limit student achievement by impeding reform and innovation (Fullan, 1993; Hill & Russell, 1999). This paper, which reports a qualitative study undertaken over three years in Victorian state schools, suggests that boundaries need not be viewed negatively if knowledge building is taking place within them, and if members look outward to make links across the boundaries of their roles and their classroom, school or discipline, to interact with a wider society.

Knowledge building is activity directed towards the creation of knowledge—in the form of products, principles and theories—often through viewing current information and knowledge from different perspectives and making new connections (Scardamalia & Bereiter, 1996). It is the intended outcome of a constructivist approach to teaching and learning, effected through the everyday classroom work in schools, and with outcomes for both students' and teachers' learning. In this approach, teachers are expected by some to be facilitators of student learning rather than instructors transmitting information, a role shift that is said to be assisted by the spread of technology, which forces teachers to relinquish power over classroom knowledge (McRae, Ainsworth, Groves, Rowland, & Zbar, 2001; Means & Olsen, 1994). The result of this open-ended approach is knowledge that is temporary, developmental, non-objective, internally constructed and socially and culturally mediated (Fosnot, 1996). A deeply social constructivist approach views knowledge itself as existing in society rather than in the mind (Scardamalia & Bereiter, 1999).

As is common in many countries, for more than a century the design of schools and their organisation in Victoria has been based on a model of one teacher working with one class group at any one time, often behind closed doors. This is accompanied by a division of the curriculum into key learning areas (Board of Studies, 2000) that are often the domain of specialist teachers, particularly in secondary schools. Where their work is bounded and made private in this way, professional conversations and observations of other teachers seem to be discouraged (Ball, 1996), thereby reducing opportunities for creating and sharing knowledge and building up the intellectual and social capital of the school and the community.

In recent years the value of workplace learning has been recognised in schools, as in industry. This can occur through school-based workshops, reflection on classroom practice, and informal, serendipitous

learning. Hargreaves (1999) argues that although teachers create new knowledge through their work, it is often poorly documented and must be better managed to capture both tacit and explicit forms, by teachers working together and by practitioners linking with researchers across the practice-theory boundary. Further, a recent Australian report into teacher development suggested that both schools and education systems require structural changes because the nature of the teaching profession limits school-based collaborative teacher learning (Department of Education Science and Training, 2001). In light of the increasing complexity of teachers' work, a projected worldwide shortage of teachers and the possibilities afforded by technology, it has been suggested that the roles of teachers in future will be disaggregated to allow for specialisation (Beare, 2001) and that the collective competencies of groups of teachers will provide the means to meet the requirements of teaching and learning (Cornu, 2001). The study reported here therefore aimed to identify teachers' roles in classrooms using computers and to document instances of practice likely to enhance knowledge building.

Communities of practice

Wenger's (1998) social theory of learning, and in particular, the concept of the community of practice, addresses learning in the context of social practice. In this paper, knowledge building is the practice to be discussed. Wenger suggests that indicators of a community of practice include sustained mutual relationships, shared ways of engaging in activities, rapid flow of information and propagation of innovation, and knowing what others can do. A class of students with their teacher can therefore be viewed as a community of practice. Such communities create boundaries through formal and informal means such as language, the use of particular spaces, and devices including classroom rules.

Across a school, Wenger suggests, the actual building is appropriated and reified in different ways by the communities of practice within it, that are often based in privatised, bounded classrooms depending on age and domain interest. However there are opportunities for bridging boundaries through two types of connections. The practices of different communities can influence each other through boundary objects (artefacts, documents, terms or concepts) and brokering (connections made by people). Important boundary objects include curriculum and standards frameworks documents, school policy documents and the discourses associated with various learning activities. Brokers are those people—teachers, principals, researchers, industry experts and students—able to make connections across communities of practice and open new possibilities for meaning. They have expertise but are not narrowly focused, as they need to operate at the periphery rather than at the core of a practice. They are clearly members of a particular community, which brings the legitimacy and credibility of an insider, but marginal, looking outward for different perspectives, and familiar with a range of discourses. Individual teachers have many opportunities for brokering inside the school, as they participate in multiple communities of practice, such as curriculum and welfare teams, or meet with several classes between which they can span boundaries.

Wenger argues that education is not limited to schooling, but is a mutual development process between communities and individuals, forming new identities. Designing education then, is not just planning a curriculum, but creating an architecture that allows the formation of identities. For this reason, Wenger suggests three infrastructures: engagement, imagination and alignment. The first, engagement, includes places for people to come together to engage in shared work, the second, imagination, refers to materials and experiences with which to build an image of the world and themselves, and the third, alignment, ways of having an effect on the world and making their actions matter. Further, he suggests that a learning community must push past its boundaries and interact with other communities of practice in a purposeful way, it must link participation inside with that outside the community, it must use the styles and discourses of the areas it wants to affect, and it must become involved in the organisational arrangements of its own institution. To encourage knowledge building in communities of practice, such as exist in the classrooms of a school, Wenger argues for a minimalist design: a framework bounded by shared language, expertise or rules, but with considerable internal space allowing for learning. The empirical research reported here suggests several ways in which teachers have enacted this design brief, pointing to future possibilities for reform.

Research Design

This paper addresses two major questions: what roles do knowledge-building teachers play in classrooms using computers and what characteristics of communities of practice are evident in these classrooms? Teachers were not merely subjects of the research, but partners in the process, and the resulting knowledge is seen to be the output of a collective enterprise, to be shared by participants (Freire, 1993; Thomas, 1993). Using regular classroom observations, document analysis and reflective conversations with thirty-two teachers and principals as the major means of data collection, the study reported here first identified the roles teachers are playing in classrooms using computers, where they might be expected to display the characteristics of facilitators. Within each of the four roles, a set of characteristics deemed to support knowledge building was identified. These were based on instances of practice—often singularities, supported by literature—rather than quantitative measures. The choice of this methodology was derived from Bassey (2001) who argues that it is possible and useful to formulate the outcomes of empirical research as fuzzy generalisations: that particular events may lead to particular consequences. This allows for prediction based upon thick description and instances of what could be (in addition to what is). Since this study looks to the future of teachers and teaching, this approach gives some insight into the beginnings of change in teachers' roles. As they emerged from the data, the characteristics were discussed and developed with the participating teachers as part of the reflective conversations, following a grounded theory approach, to create a table of characteristics. Finally, as the results appeared to show developing communities of practice in many cases, they were scrutinised in light of the three parts of the learning architecture outlined in Wenger's (1998) theory of communities of practice: engagement, imagination and alignment.

Teachers' roles in classroom communities of practice

The roles teachers play in classrooms using computers are shown in Figure 1. Teachers are at the centre of the model, as the study focused on teachers', rather than students', learning. As the transcripts were coded, four broad role categories emerged among all teachers: designing the learning environment, managing people and resources, mediating student learning and improving practice.

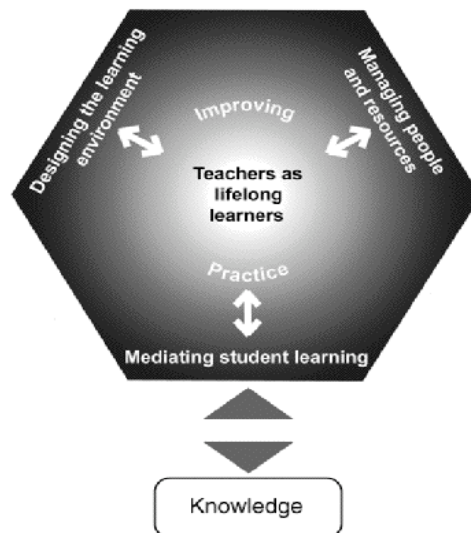


Figure 1: Four roles for knowledge-building teachers

Designing is a planning role in respect of the curriculum and the physical environment, and generally takes place outside classroom time. Managing people and resources involves making decisions that operationalise the design, such as liaising with students, teacher and experts involved in the classroom, and

maintaining resources such as computers. Mediating student learning is the role that demands expertise in helping students learn how to learn, through dialogue, coaching, and processes of monitoring. The fourth role, improving practice, affects and is informed by all other roles, and is shown as central. The boundary hexagon delimits the classroom community of practice. Although all teachers in the study operated individually with a class of students and therefore covered all roles, there appeared to be some specialisation occurring, indicating that these roles could disaggregate in future, as Beare (2001) predicts. The model accommodates this by labelling the central circle *teachers as lifelong learners*.

Within the four roles, a set of characteristics of knowledge-building teachers was derived from the data, according to the research design. These characteristics were not evident in every setting, but their existence raises the possibility, as Bassey suggests, of *what could be* in future. These characteristics, as shown in Table 1, provide a descriptive framework for teacher reflection on current practice, as well as a tool for the preparation of new teachers.

Table 1: Characteristics of knowledge-building in four roles of teachers

Designing	Managing	Mediating	Improving
Teachers' understandings about student learning inform design	Teachers involve students in management	Teachers help students learn how to learn	Teachers encourage each other in new ways of working and learning
Teachers incorporate, but are not bound by, curriculum frameworks documents	Teachers encourage student motivation through intrinsic means	Teachers share teaching and learning with students	Teachers frame personal and social goals for their learning
Teachers share a common discourse of planning	Teachers model collaborative knowledge-building and management practices	Teachers and students monitor and assess learning together	Teachers make time for sustained professional learning in the workplace
Teachers have a clear purpose for technology use	Teachers manage technology as a resource for students to build knowledge	Teachers build on students' prior experience	Teachers learn through play
Teachers involve students in curriculum planning	Teachers manage relationships between people for authentic learning	Teachers facilitate connections between people	Teachers learn through dialogue and conversation
Teachers design in professional collaboration within and across schools	Teachers manage connections across boundaries	Teachers focus on knowledge-building activities	Teachers freely share their knowledge
Teachers plan purposeful tasks which require collaboration between students		Teachers scaffold student learning individually and collectively	Teachers reflect on their practice and share their reflections
Teachers cross the boundaries between key learning areas		Teachers and learners talk together to increase learning	Teachers innovate and document innovative practice
Teachers design for open-ended learning			Teachers contribute to school-wide decision-making
			Teachers develop theory from their practice

Once the knowledge-building characteristics of the four roles were identified in this way, they were scrutinised in light of Wenger's (1998) theory of communities of practice, to determine whether these characteristics did in fact constitute behaviour typical of a community of practice, and to identify any areas of his theory that were not found in the data. The following section considers characteristics particularly related to brokering relationships across boundaries, and the use of boundary objects, in terms of the three facilities of Wenger's learning architecture: engagement, imagination, and alignment.

Knowledge building among teachers in communities of practice

Wenger suggests that his architecture is a framework for asking how a specific means of organisation provides facilities that support engagement, imagination and alignment: how they enhance the community of practice in its work. The findings indicated strong support among the teachers studied for facilities supporting engagement and imagination, and less support for alignment.

Facilities of Engagement

In their designing, managing and mediating roles, teachers clearly focused on encouraging engagement by using spaces for interaction and encouraging participation in joint tasks. Teachers intentionally designed and managed the physical space of classrooms and the digital space of Intranets for interaction with and between known students, particularly in primary schools. These class groups formed geographically-bounded communities, underlined by the timetables, which generally offered (and required) physical interaction only from about eight o'clock in the morning until three in the afternoon. Primary schools were less constrained by the time boundaries within this period than secondary schools, where the timetable forced short rotations through different communities of practice (defined by subjects and class groupings) over the course of a day. In spite of the reification of the key learning areas of the curriculum (Board of Studies, 2000) primary schools crossed these boundaries and offered some integrated studies, creating strong links. In secondary settings these boundaries were weakly bridged as people, particularly students, participated in multiple communities of practice: potentially, but not necessarily, bringing knowledge from one to another.

Within the classroom community, teachers also involved students to varying extents in joint tasks in designing, managing and mediating their learning (for example, teaching other students, engaging in self-assessment). This has the effect of changing the boundaries between teacher and student, expert and novice. Where all are learners depending on the situation and teachers share their professional expertise, the broad concept of teachers' roles has already changed, as one principal explained:

It's developing a partnership with the kids saying, "We are learning this together. We've got a framework in which we are going to learn this stuff and there has to be some kind of rules and fences around that. But within that we are learning together". I think that's the thing that we have developed very well in the school (primary principal).

Technology provided a means of crossing boundaries through email, Intranet and chat rooms that were used inside and outside the class, especially where students had access to computers at home. It allowed students to take charge of their learning, to increase their knowledgeability and to explore new territories. In some schools students used communication technologies to work with experts outside the community of practice. These activities deepened feelings of membership and connectedness in the classroom community for both teachers and students, as one teacher described:

Once we started connecting with people the kids had a purpose: a task that kept them motivated. It was exciting for them to have someone else to talk to. Those kids just walked out of here completely different (primary teacher).

In the physical location or in virtual space, and particularly in primary schools in this study, there were teachers who engaged in shared tasks (particularly in their designing role) through planning together, and in peripheral encounters across the boundaries of classroom walls. Such teacher-brokers disseminated knowledge and built new knowledge through new connections between both students and teachers. They also encouraged generational encounters that crossed age boundaries, such as valuing parents, grandparents and industry partners in the learning process. One means of crossing the boundary between schools was displayed by teachers and students who used video conferencing between classrooms. During the course of the conferencing, teachers and students in two schools could see into each other's classroom culture, albeit briefly. One teacher described the advantage of the video:

The closed-door syndrome really is out there. Let's leave the door closed but let's get into the room. Teachers feel most comfortable in their own environment and that's where the practice is going to take place (primary teacher).

Improving practice, as occurred through this experience, is a constant role that derives from and informs teachers' daily work. Those who documented their processes and products made their tacit knowledge explicit, helping to accumulate a history of shared practice and to develop a common professional enterprise, but this tended to be most common within schools than across their boundaries.

Teachers in this study saw engagement as physical connectedness, supported but not replaceable by virtual connections, and providing students with a safe and secure environment for learning and constructing identity. Wenger acknowledges that strong engagement in a community of practice might appear to be a limitation, but argues that it empowers people to negotiate their enterprise and thus to shape the context in which they can construct and experience an identity of competence. Teachers often referred to this in terms of student autonomy and self-esteem.

Facilities of Imagination

Imagination refers to materials and experiences with which people build an image of the world and themselves. Many teachers encouraged a sense of belonging to a strong community and explicit learning about self in order to grow and develop. This was particularly evident among the primary teachers, who frequently articulated their role as supporting students in the learning process, as did this teacher:

It's to provide the support that they need to become independent. They learn how to learn (primary teacher).

There were many signs in this study that teachers valued the openness and exploration of the constructivist approach, both for themselves and their students, but in some cases, teachers felt governed and constrained by statewide curriculum frameworks and policy documents. Those who conceptualised curriculum frameworks documents as minimalist, waiting to be filled with authentic learning activities, were confident in their ability to encourage student exploration, and could see the potential for purposeful technology use when designing the learning environment. One teacher described how his team was confident rather than constrained when basing curriculum planning on framework documents:

It gives the teachers a wonderful starting base. So we have it open on three or four machines gathering ideas and using it as a starting board or a springboard for our learning. We also have a matrix of technology use in the school (primary teacher).

Teachers like these recognised that there were choices in technology use that enhanced their purpose of knowledge building. The activities they designed, their management strategies, and their mediation were based on travelling across boundaries. Similarly, in terms of improving their own practice, these exploration cultures supported teachers learning through play (alone or together), often resulting in innovation. Teachers made new connections and created new knowledge in a variety of ways, such as visiting other schools, working with other teachers via video conference and presenting at seminars and conferences. One secondary teacher, however, felt that more needed to be done:

Teachers need to be allowed to have a professional discourse around the changes that technology has brought to society, including things like the digital divide and all those other sociological issues (female secondary teacher).

Facilities of Alignment

Alignment, according to Wenger, occurs through shared vision, language, policies and procedures, while the strength of community that results also affords ways to have an effect on the world outside the boundary of the community of practice. In this study, the umbrella of the state education system and its curriculum and standards frameworks acted as a tool of statewide convergence, allowing teachers the opportunity for shared discourse and boundary encounters that supported professional practice. Within schools this was particularly evident in the primary settings that were structured so that teachers did much of their work collectively, as one participant explained:

It's not about your grade of twenty-six or your grade of twenty-four. They're all our children and we all collectively — including the office staff, the grounds man, the Principal and myself — see they are all our children. It's about educating our collective group of children (primary assistant principal).

Teachers in the secondary settings in this study felt more limited by the discipline boundaries and the spectre of external examinations.

After at least a decade of focus on outcomes and accountability, some teachers had appropriated boundary objects like curriculum standards frameworks, strengthening the understanding between communities of practice. In these cases local discourse was supplemented by the shared discourse of the statewide documents. Several teachers in this study brokered relationships with researchers to cross the traditional boundaries between practitioners and researchers, while maintaining the separate roles. Such a partnership can help make tacit knowledge explicit, develop a shared discourse and take the explicit knowledge of both groups to a wider audience. One principal commented:

You don't want teachers always researchers. You don't want to take them away from their core business. Their gut feeling is that what they do works, but they're constantly being asked to prove it, and that's the researcher's role (primary principal).

In the study, data showing aspects of alignment were less common than for engagement and imagination. For example, alignment was noted generally in relation to school and system policies and procedures, particularly to do with curriculum, rather than documenting a wider range of processes. Although Hargreaves (1999) suggests that schools should cast a wide net by auditing what they don't know as well as what they know, there was little evidence of teachers collecting data other than that mandated by the system. In spite of their extensive knowledge and experience in designing, managing and mediating learning, few teachers displayed broad participation in making explicit their tacit knowledge to inform the shaping of the school beyond their classroom. In Wenger's terms, by not becoming involved in the organisational arrangements of their own institution, they were failing to support alignment.

In spite of the systemic umbrella, the enormity of the cultural gulf between primary and secondary communities was raised by both primary and secondary teachers on several dimensions, including curriculum and organisational practices. Two teachers analysed the difference between the types of school culture in terms of student autonomy and leadership. From the primary perspective, one said:

It really does seem sad that you get the [Year] 6s to the point where they are really responsible and firing on all four cylinders and then they have their wings clipped and they have to conform, rather than being allowed to be the decision-makers in the learning (primary teacher).

Her secondary counterpart had a similar concern:

You get kids who have been members of junior council who have been mediating disputes between kids. They come up here and they are suddenly nothing and no one. So I think we need to learn from our primary colleagues. Primary teachers have a way of dealing with kids and a way of speaking and questioning kids that is very different from secondary (secondary teacher).

Few of the primary teachers had actually seen secondary classrooms in action, and vice versa, although one primary school reported a program whereby local secondary teachers shadowed teachers in the classrooms. Although boundary objects (such as curriculum documents and student reports) exist to bridge this gulf, this boundary appears to be particularly lacking in brokerage. For example, secondary teachers tended to share knowledge with other secondary teachers rather than with the whole system.

Islands of excellence and constellations of communities

Taken as a whole, the findings broadly show that many of the characteristics of Wenger's learning architecture exist in schools at the classroom level where one teacher relates to each class group. Teachers are particularly interested and effective in enhancing engagement through social interaction supporting learning. Imagination—building an image of self and the world—is supported through trust, openness and reflection. This has the effect of deepening and strengthening the teacher-led community of practice. Alignment is encouraged by education systems, by virtue of the fact that they are connected systems. However for most teachers, alignment appears to be more to do with common vision within the community than with having an effect on the world. Although some knowledge-building teachers clearly act as brokers to facilitate boundary encounters, early knowledge-building communities remain as 'islands of excellence with no ferry service' (Reilly, 1999).

However, connections need to be made between communities of practice to enhance knowledge building as a social practice. The islands of excellence in a school can be reconceptualised as a constellation of communities connected both intentionally and by circumstance. Boundary objects such as documents and web sites that make tacit knowledge explicit (Hargreaves, 1999) assist in sharing knowledge across boundaries, and teacher-brokers are located nearer the periphery than the centre of each community, making links at school and cluster level, as well as globally. As Hargreaves (2003) suggests, an education system that consists of schools linked to each other in networks — where those that are sources of best practice become nodes — can harness the potential of information and communication technologies to achieve transformation.

The implications for teachers' roles are challenging. If communities of practice are to learn, create knowledge and influence society, as Wenger suggests, teachers need to reconceptualise their roles as members of collective enterprises engaged in knowledge work, rather than as purely facilitators of student learning. While an individual teacher can facilitate student learning in isolation from other teachers, in the definition proposed by this study, teachers as knowledge builders cannot. In the words of one principal:

You can't be a little island in your classroom with your door shut like we used to be (primary principal).

Knowledge-building teachers work together to design and manage the learning environment to increase the sum of community knowledge, through mediating student learning. Individual student learning outcomes are seen as part of the community's knowledge, as one teacher expressed:

We challenge them: If you know something you must share it (primary teacher).

Similarly, knowledge-building teachers will continue to see themselves as learners, and the knowledge they create will contribute to the collective competence of the profession, and be valued as such. This study indicates that the shift is occurring gradually.

Conclusions

The view of teachers' roles presented in this paper demands a commitment to interdependence, where teachers are as concerned with the progress of other teachers and the school as a whole as they are with their own success. In some instances, teachers already undertake aspects of their work in teams as a matter of course, where the school structures support this, particularly in primary schools. But while teachers aim to cover the whole range of classroom teaching roles individually, they determine their own classroom practices, allowing the structural isolation to continue. This study found indications of specialisation in the roles of designer, of manager, and of mediator of student learning, indicating that these roles might become separate aspects of a team approach in future.

Considering classrooms as communities of practice recognises the importance of sustained mutual relationships and shared ways of building knowledge, as Wenger describes. School cultures characterised by an understanding of their intellectual capital and propagation of innovation represent communities of practice at a broader scale. It appears, however, that teachers in secondary settings have less sense of a school-wide community than their primary counterparts, as they are often fragmented by disciplines and year-levels. Statewide systems provide an infrastructure with potential for knowledge building. The challenge for teachers, schools and systems is to build on the experience of those who have created confident, bounded and connected communities of practice and to work together to devise suitable local models for action that support knowledge building in many settings.

If education systems want teachers and schools to engage in knowledge building they need to ensure that they are engaged in knowledge building through their own structures and behaviours. This would require a balance between system facilities of engagement, imagination and alignment and trust in schools and teachers, enabling them to bring about their own transformation. The findings indicate that in some cases teachers feel constrained rather than supported by the extent of accountability frameworks, and their discourse is often framed in system terms to the exclusion of personal theorising and a local discourse of supporting engagement, alignment and imagination. Local communities of practice need to be involved in designing their own learning, but not to the exclusion of other points of view. Hence communities of practice must cross boundaries and learn the language of other groups, as well as encouraging a diversity of perspectives within the community.

Teachers' learning opportunities should be based on the principles identified for student learning, bearing in mind Wenger's view that a robust design is a minimalist design, allowing for emerging opportunities to be taken up. They should be situated in the sense that they are teacher driven (Clark, 2001) — although not necessarily workplace based — and connected with broad social purpose. Reflection should be promoted as a means of professional learning, as is the case now. However a wider range of forms of reflection could be used, taking into account its purposes and people's learning styles. Social reconstruction, rather than individual *navel-gazing*, should be highlighted as a purpose of reflection (Cochran-Smith & Lytle, 2001). The forms of reflection could include and value oral tradition rather than reifying only that which can be printed, so that providing real opportunities for teachers to talk together could be enough in some cases. Technology can support this through audio recording and video and teleconferencing, while tools based on Table 1 can guide reflection towards large-scale issues and point to development needs.

Teachers themselves should reflect on, and talk about, emerging roles and role configurations and that this should be a topic of interest at school and system level. If teachers wish to refashion their roles based on a model of collective competencies (Le Boterf, 2000; Levy, 1996), this also has implications for skill and knowledge development, industrial agreements, performance management and competency regimes. It requires an attitude of interdependence leading to concern with the progress of self, others, and the whole school community. More teachers would have to see themselves as leaders and followers, as experts and novices, as teachers and learners. They would need to contribute their experience to the decisions made at school and system levels. The related areas of enterprise agreements, performance management and rewards would need to acknowledge the collective, rather than individual, nature of teachers' work. In all cases, better systems of knowing and recording what people bring to their work would be required.

A major change in role configurations is unlikely in the time and space geography currently prevailing in schools, particularly in secondary schools. The arrangements in both primary and secondary schools should be reviewed, as Hill and Russell (1999) argue, to identify appropriate organisational changes that support knowledge building as described in this study. This is not to say that secondary schools should be more like primary schools, but that the characteristics identified in this study should be interpreted for both settings. For example, domain specialists are valuable, but subject demarcations do not necessarily follow from this.

Using time as a measure of work done needs to be challenged. In future more teachers might spend less time in the classroom and more on supporting learning, as Hord (1997) argues. Professional development policies that focus on providing emptiness — space for reflection, collaboration, conversation and debate — will support an emphasis on creation rather than consumption of knowledge. As this study found, teachers and students learn from activities when they see a purpose for themselves. The opportunities for such purpose-driven learning need to be available in the *pedagogical moment* (van Manen, 1991), so that purposeful authentic teacher learning can be embedded in curriculum projects, both local and large scale.

The skills and knowledge required by different teachers will differ and the notion of a ladder or stages of competence will be replaced by a web of skills, gained through a process that a participant in this study named *hyperlinked learning*. As an example, the evidence that teachers in this study have appropriated various aspects of technology and studied them in depth indicates that learning to use technology may not occur in stages, but in points, or nodes, linked to other nodes, depending on purposes.

There is some tension between the need to make processes and outcomes transparent and to pass on knowledge, and the possibility that as soon as it is documented it is out of date. Again the question of empty frameworks arises: is it more important to produce knowledge or to develop the space in which knowledge can be created? Although Hargreaves (1999) calls for both explicit and tacit knowledge to be articulated, a healthy amount of documentation is likely to be that which meets the purposes of the audiences, without overload. Documentation for its own sake, or that attempts to reify tacit knowledge, could be more annoying than helpful, and lead to entrenched positions rather than flexibility. Similarly on-line support for teacher learning needs to be based on an open-ended, constructivist approach which values their prior experience and multiple perspectives, and, based on the findings of this study, will be used where teachers have a purpose and access to the required infrastructure.

Collaborative partnerships whereby classroom communities work together, teacher communities work together, and the teacher and researcher communities work together have the potential for social transformation. Teachers in this study have shown that where there is a culture of learning from each other, the media afforded by technology can assist both in recording and sharing ideas and practices. The key is in bridging the boundaries of communities of practice. In the short term the need for brokerage across the boundaries of primary and secondary schooling is particularly urgent, while ways to travel across other boundaries, such as disciplines and key learning areas, timetables and class groupings, should be explored. Only then will education systems be seen as communities of practice engaged in knowledge building for a better society.

Acknowledgement

This research was supported by funding from ARC Linkage Grant C77906981

References

- Ball, D. (1996). Teacher learning and the mathematics reforms: What we think we know and what we need to learn. *Phi Delta Kappan*, 77(7), 500-508.
- Bassey, M. (2001). A Solution to the Problem of Generalisation in Educational Research: fuzzy prediction. *Oxford Review of Education*, 27(1), 5-22.
- Bearé, H. (2001). *Creating the Future School*. London: RoutledgeFalmer.
- Board of Studies. (2000). *Curriculum and Standards Framework (CSF II)*. Melbourne: Board of Studies.
- Clark, C. (Ed.). (2001). *Talking Shop: Authentic Conversation and Teacher Learning*. New York: Teachers College Press.
- Cochran-Smith, M., & Lytle, S. (2001). Beyond Certainty: Taking an Inquiry Stance on Practice. In A. Lieberman & L. Miller (Eds.), *Teachers Caught in the Action: Professional Development That Matters* (pp. 45-58). New York: Teachers College Press.
- Cornu, B. (2001). *Winds of Change in the Teaching Profession*. Paris: French National Commission for UNESCO.
- Department of Education Science and Training. (2001). *Making Better Connections: Models of Teacher Professional Development for the Integration of ICT into Classroom Practice*. Canberra: Department of Education Science and Training.
- Fosnot, C. (1996). Teachers Construct Constructivism: The Centre for Constructivist Teaching/ Teacher Preparation Project. In C. Fosnot (Ed.), *Constructivism: Theory, Perspectives and Practice* (pp. 205-216). New York: Teachers College Press.
- Freire, P. (1993). *Pedagogy Of The Oppressed: Twentieth Anniversary Edition*. New York: Continuum Publishing Co.
- Fullan, M. (1993). *Change Forces: Probing the Depths of Educational Reform*. London: The Falmer Press.
- Hargreaves, D. (1999). The Knowledge-Creating School. *British Journal of Educational Studies*, 47(2), 122-144.
- Hill, P., & Russell, V. J. (1999). Systemic, Whole-school Reform of the Middle Years of Schooling. In R. Bosker, B. Creemers & S. Stringfield (Eds.), *Enhancing Educational Excellence, Equity and Efficiency* (pp. 167-196). Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Hord, S. (1997). *Professional Learning Communities: Communities of Continuous Inquiry and Improvement*. Retrieved 6 November, 2002, from <http://www.sedl.org/pubs/change34/4.html>
- Le Boterf, G. (2000). *Construire les compétences individuelles et collectives*. Paris: Editions d'Organisation.
- Levy, P. (1996). *Education and Cyberculture*. Retrieved 3 February, 2003, from <http://sgwww.epfl.ch/UF1/observatoire/levy>
- McRae, D., Ainsworth, G., Groves, R., Rowland, M., & Zbar, V. (2001). *PD 2000 Australia: A National Mapping of School teacher Professional development*. Canberra: DETYA.
- Means, B., & Olsen, K. (1994). The link between technology and authentic learning. *Educational Leadership*, 51(5), 15-19.
- Reilly, R. A. (1999). *EdNet@Umass: Providing Quality Professional Development via the Internet*. Retrieved 8 April, 2003, from www.thejournal.com/magazine/vault/A2098.cfm
- Scardamalia, M., & Bereiter, C. (1996). Engaging Students in a Knowledge Society. *Educational Leadership*, 54(3), 6-10.
- Scardamalia, M., & Bereiter, C. (1999). Schools as Knowledge Building Organizations. In D. Keating & C. Hertzman (Eds.), *Developmental Health and the Wealth of Nations: Social, Biological and Educational Dynamics* (pp. 274-289). New York: The Guildford Press.
- Thomas, J. (1993). *Doing Critical Ethnography*. Newbury Park, CA: Sage.
- van Manen, M. (1991). *The tact of teaching: the meaning of pedagogical thoughtfulness*. Ontario: Althouse Press.
- Wenger, E. (1998). *Communities of Practice: Learning, Meaning and Identity*. Cambridge: Cambridge University Press.