LEARNING AND DOING IN COMMUNITIES: UNDERSTANDING KNOWLEDGE MANAGEMENT THROUGH THE LENS OF ACTIVITY THEORY

Helen Hasan

Department of Information Systems,
University of Wollongong, Australia
hasan@uow.edu.au

Session E-1

Abstract

In businesses, government departments and educational institutions, most innovative knowledge creation is achieved, not at the organisational or individual level, but in communities of people who have come together with a common interest. This paper describes a sequence of cases from a research project on the development of socio-technical systems, which support geographically dispersed communities, demonstrating that such communities are viable for both practice and learning, within and between organisations. The Cultural Historical Activity Theory concept of *activity* is used as the unit of analysis to explain what individuals or small groups of people do in a variety of contexts when supported by socio-technical systems in a flexible, multifaceted model of learning through practice in communities.

Keywords: activity theory, knowledge creation, communities, information and communications technologies.

Learning and Doing in Communities: Understanding Knowledge Management through the Lens of Activity Theory

Helen Hasan

Department of Information Systems,
University of Wollongong, Australia
hasan@uow.edu.au

Abstract

In businesses, government departments and educational institutions, most innovative knowledge creation is achieved, not at the organisational or individual level, but in communities of people who have come together with a common interest. This paper describes a sequence of cases from a research project on the development of socio-technical systems, which support geographically dispersed communities, demonstrating that such communities are viable for both practice and learning, within and between organisations. The Cultural Historical Activity Theory concept of *activity* is used as the unit of analysis to explain what individuals or small groups of people do in a variety of contexts when supported by socio-technical systems in a flexible, multifaceted model of learning through practice in communities.

Keywords: activity theory, knowledge creation, communities, information and communications technologies

Suggested track:

E Communities of practice, knowledge networks and networking

1 Introduction

The Australian Standard (AS5037(INT)-2003) defines knowledge management (KM) as "a multi-disciplined approach to achieving organisational objectives by making best use of knowledge. It involves the design, review and implementation of both social and technological processes to improve the application of knowledge, in the collective interest of stakeholders." This definition is the culmination of a growing body of literature (Boland & Tenkasi 1995, Engeström 1999, Toulmin 1999, Wenger et al 2002), which promotes a view of socially-constructed, collective knowledge as the predominant source of learning, creativity and innovation. Moreover this focus promotes knowing as an activity by specific groups of people in specific circumstances for a specific purpose. In highly commercial firms, government departments and educational institutions, desirable outcomes are commonly achieved, not at the

organisational or individual level, but at the group level in work units, cross-functional teams or communities of people who have come together with a common interest. (Linger & Warne 2001).

New information and communications technologies (ICT) are enabling and supporting communities that span conventional boundaries of learning and doing, as well as space and time. The resulting innovative socio-technical systems, involving groups of workers and learners, warrant continued study in the field of knowledge management.

This paper begins with a discussion of ICT enabled groups and communities and then investigates some holistic theoretical frameworks that could be suitable as a basis for research into such socio-technical phenomena. A sequence of cases is reported from a research project on the development of systems, which support knowledge creation in geographically dispersed communities, demonstrating that such communities are viable for both practice and learning, within and between organisations.

The focus of this project, on socio-technical systems for communities of practice and learning, requires a flexible, holistic research method. For this reason, the Cultural Historical Activity Theory (CHAT) has been chosen as a suitable framework for the research as it provides a rich holistic understanding of how people do things together with the assistance of sophisticate tools in complex dynamic environments (Hasan 1999). Following the presentation of the case studies, the CHAT concept of *activity* is used as the unit of analysis to explain what individuals or small groups of people do in a variety of contexts when supported by socio-technical systems in a flexible, multifaceted model of learning through practice in communities.

2 ICT enabled Groups and Communities

2.1 Learning and doing by means of socio-technical systems

With the growth of the Internet, the concept of community is being revived and revised in virtual space as one of the emerging business strategies in the globalised environment. Online communities can be properly regarded as complex socio-technical systems (Hasan & Crawford 2003). This work demonstrates a convergence between emerging Web-based groupware systems, communities of practice in business and new forms of online learning in educational settings. The resulting flexible socio-technical systems are developing capabilities for both learning and working in complex virtual settings. Self-sustaining communities require systems that

support genuine knowledge creation and purposeful innovation by increasing an individual, or group's, capacity to take effective action to achieve meaningful goals.

In this paper the generic concept of community is used, without qualification, in recognition of the fact that there are many different creative collections of people: teams, groups, work units, clubs, professional societies, as well as communities of interest, practice and learning. Some are co-located and some meet predominantly online. They may vary in size, length of existence and degree of formality, but each has its own common history, culture, knowledge and purpose. While the differences between them are not trivialised, this paper will focus more on characteristics and challenges that are found in most communities with respect to KM and on the belief that all communities are formed around a common interest and engage in activities that involve both learning and doing.

A comprehensive industry study (AA 1999) into the significance and adoption of on-line communities (OLC) in business, reports that the expectations of sponsored OLC are that "they provide faster more efficient communications, higher levels of innovation and collaborative creation of new products or processes". The fact that communities are being recognised as a source of business value justifies more research into the role of socio-technical models of communities. It is not surprising then that the concept of 'community of practice', made popular by the work of Wenger (Wenger et al 2002), to cover a holistic, systemic view of community, has captured the attention of many in the area of KM. There is a business imperative for intellectual capital creation which is a socially constructed dynamic process of situated collective knowing that is capable of being leveraged into economic and social value (O'Donnell et al 2003). Likewise, there is a pedagogical imperative for creating learning environments that take advantage of the dynamic developmental nature of communities of practice to make the experience of learners relevant to the ever-changing, ICT-enabled world in which they will live and be employed.

Communities are collections of people that engage in activities that encompass a common interest and ongoing learning through practice, not only in their leisure time, but also as part of their work as employees of organisations or in classes at educational institutions. A closeknit community is a fertile environment for learning and innovative practice and many such communities of practice now exist online. One aim of the research described in this paper is to better understand how these online communities work and a second aim is to develop, through an iterative evolutionary prototyping process, a web-based groupware system that can be used both to sustain

and to study such communities. A longitudinal study being conducted in networks of community technology centres in numerous regional settings in Australia is one application of this system. Another is to support distance learning in business-related courses in tertiary educational institutions and some of the cases described here relate to that use. The premise is that the core determinant of learning in this environment is not the characteristics of the technology alone but the establishment of a supportive community environment where teacher and students can work together to allow learning to occur.

In changing situations of knowledge acquisition and use, the new interactive technologies are redefining, in ways yet to be determined, what it means to know and understand, and what it means to become "literate" or "an educated citizen" (Lave & Wenger 1991). ICTs are dramatically transforming the basic patterns of communication and knowledge interchange in societies, and automating the human processes of thinking and problem solving. The new forms of collective activity, made possible by ICT tools, have enabled much more variety in organisational structures and processes in business as well as education. Large and small organisations, businesses, government entities, small to medium enterprises, micro-businesses, non-profit and community organisations are all struggling with changing environments and are under stress to survive and thrive. To do so, people in these organisations need to work together to become learning organisations. However there is a great deal of controversy surrounding the notion of managing collective knowledge. The term "management" commonly implies a focus at the level of organisation, whether public or private, formal or informal, large or small. In contrast the use of the term "knowledge" the focus is commonly on individuals. Enlightened businesses are recognising the importance of sustaining as intermediate level between the individual and the organisation.

If organisations are to refocus on this intermediate level there must be a greater understanding of how productive work takes place in network-centric organisations (Alberts et al 2000) where loosely coupled autonomous teams behave as self-organising organic communities. In network-centric organisations connections between central management and other enterprise components are weak so that attempts at control through hierarchical organisational structures often fail. On the other hand connections among constituent components are strong and stable group patterns can emerge and resist change through repeated interaction, mutual goals and experiences (Kurtz and Snowden 2003). This is the complex organic culture, which organisations

need to cultivate if they seek innovation through self-adapting teams in a network-centric organisational arrangement, which can reap the potential benefits of linking together organisational entities to achieve synergistic effects. One aspect of the network-centric culture that needs greater attention is the nexus, for both individuals and collections of people, between learning and doing, just as there is between knowledge and action, as learning is an integral part of generative social practice.

2.2 Theories and frameworks

In searching for a theoretical basis for this research, a natural starting place would be the knowledge creation framework of Nonaka (1994), which was a major incentive for the KM movement, and Wenger's (1996) seminal work on communities of practice. These two bodies of research that have influenced this work and will be briefly discussed here. However as intimated earlier, it may be preferable to analyse rapidly-changing, socio-technical, self-adapting communities in terms of activity systems (Engeström 1999).

The socialisation, externalisation, combination, internalisation (SECI) spiral of Nonaka, shown in Figure 1, has had great influence in the field of KM and it is assumed that the reader is familiar with this well-known approach. The author of this paper is not so concerned with the distinction between tacit and explicit knowledge but rather is interested in the SECI model's recognition of the difference between knowledge creation at individual, group and organisational levels. However the uni-directional nature of proposal that knowledge creation occurs as a spiral through these levels from individual to organisation, is questioned as an unnecessary restriction.

Nonaka and Konno (1998) also introduced the concept of "Ba" as a shared space for emerging relationships. This space can be physical (eg. office, dispersed business space), virtual (e.g., email, teleconference), mental (eg. shared experiences, ideas, ideals) or any combination of them. Ba is an interesting description of the conceptual space where individual and/or collective knowledge is advanced.

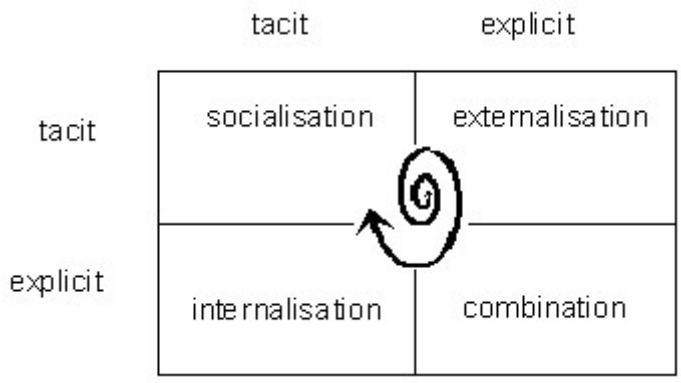

Figure 1 The SECI Spiral (Nonaka 1998)

Communities of practice (CoP) are becoming a core knowledge strategy for global organisations. Wenger and others (Wenger et al 2000) suggest that a CoP defines itself along three dimensions:

- What it is about – its joint enterprise as understood and continually renegotiated by its members
- How it functions - mutual engagement that bind members together into a social entity
- What capability it has produced – the shared repertoire of communal resources (routines, sensibilities, artifacts, vocabulary, styles, etc.) that members have developed over time.

As groups of people who come together to share and learn from one another face-to-face and virtually, communities of practice are held together by a common interest in a body of knowledge and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices. A CoP is fundamentally a self-organizing system embodying the key elements of communities, namely practice and identity although participation in communities of practice may take different forms, from core membership to that on the periphery.

CoP therefore implies a shared practice and shared knowledge and are typically boundary-spanning units in organisations. Many organisations are providing resources to support and encourage spontaneously occurring CoP, which are often global in membership. However a much greater challenge for traditional organisations is to allow, and support, a network-centric organisational structure where mainstream operations are undertaken in self-directed teams that have the beneficial characteristics of social communities.

To be able to analyse complex interactions and relationships, Engeström (1987) proposes a new unit of analysis in the concept of object-oriented, tool mediated, and culturally mediated, human activity system. As a holistic, contextual and collective entities, CoPs and Activity Systems could be considered as different views of the same reality. The notion of "activity" is interpreted from the theory of Leontiev (1981) which is, in turn, based on the psychology of Vygotski (1978). Engeström acknowledges that the internal tensions and contradictions of such an activity system, which includes both historical continuity and local situated contingency, are the motive for change and development. In a similar fashion to the SECI spiral of KM (Nonaka 1998), Figure 1, dynamic cycles of expansive learning are of crucial importance to the historical understanding of activity systems. These cycles, shown in Figure 2, combine the process of internalisation and externalisation where internalisation is the reproduction of culture by socialising and training individuals to be members of the activity system, and creative externalisation is the creation of new artefacts through innovations.

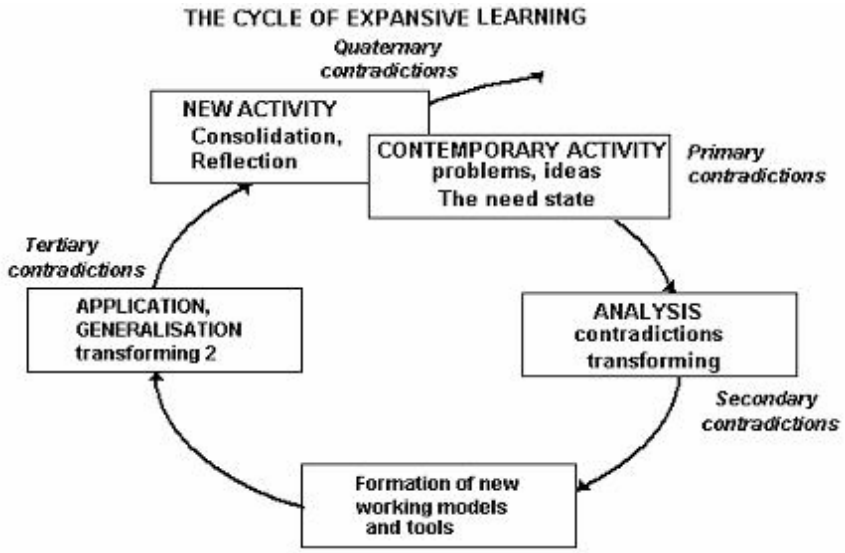

Figure 2 The cycle of expansive learning (Engeström 1999)

To provide the reader with a little understanding, and to support the analysis of the research, some fundamental concepts of activity systems and Activity Theory will now be described

3 Activity Theory: some basic concepts

Activity Theory is a social-psychological theory that has its roots in the work of the Russian psychologist Vygotsky during the first half of the 20th century. Vygotsky's

important insight into the dynamics of consciousness was that it is essentially subjective and shaped by the history of each individual's social and cultural experience (Vygotsky 1978). In addition, Vygotsky saw human activity as quite distinct from that of non-human entities in that it is mediated by tools, the most significant of which is language. Vygotsky's work was continued by others, amongst them Leontiev who developed a conceptual framework for a complete theory of human activity (Leontiev 1981). According to Leontiev (1981), activity is a system that has structure, its own internal transitions and transformations, and its own development.

Kuutti and Virkkunen's research (1995) has used activity systems as a representation of the common object of organisational work which cannot be studied by reducing the scope to one or another element, but where a minimum meaningful system as a whole should be taken as the unit of analysis and intervention. Engeström (1987) gave a more concrete expression to this structure in the triangular representation, shown in Figure 3, which is commonly used to depict an activity. The core of an activity is a dialectic relationship between subject (human) and object (purpose) mediated by tools and community. This is a two-way concept of mediation where the capability and availability of tools mediates what is able to be done and tools, in turn, evolve to hold the historical knowledge of how the communities behaves and is organised. This is particularly powerful when the tools are computer-based (Kaptelinen 1996). The formal, or informal, rules and division of labour of the community, in which the activity occurs, also dynamically mediate the subject-object relationship.

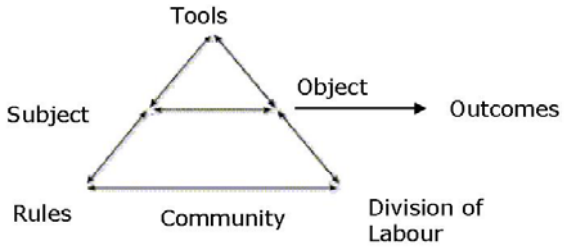

Figure 3. The subject-object relationship, which defines an activity, is mediated by tools and community through rules and division of labour. The subject may be individual or collective and outcomes of the activity are distinct from its object/purpose.

Leontiev (1981) proposed that "activity" should be placed this at the top of the hierarchy shown in Figure 4, associated sustained human endeavour with a long-term purpose and strong motives. This is a conceptual level above that at which most business

analysis takes place, which is at the level of actions, undertaken towards specific, and often short-term, goals. Under certain conditions, conscious actions can be driven to a lower level of automation, often in computer systems, as they become standardised as operations. An activity is comprised of sets of actions (towards specific goals) and operations (routine and well known habitual cognitive or behavioural processes, now commonly the domain of IT systems). Where as an activity is defined by purpose and motive and is typically a long-term affair, actions are more planned with specific goals and a more limited time span. Actions are not meaningful in themselves unless they are part of an activity. For example it makes no sense to drive to work (an action) unless there is a work activity to go to.

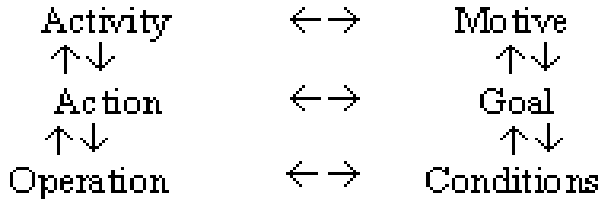

Figure 4 The definitive hierarchy of Leontiev (1981)

There may be legitimate alternative sets of actions that can enable the successful performance of an activity, for example: it is common practice in IS development to assess the feasibility of different design solutions to an organisational problem and then choose one solution to implement based on a cost benefit analysis. However there may be instances where it is feasible to allow concurrent different solutions (i.e. different sets of actions) for an activity under different circumstances (eg in different countries where cultures vary or in different divisions of a company). It is important however to have a common understanding of the object (purpose) of the activity at the top of the hierarchy.

In addition to Engeström's structure of activity (Figure 3) and Leontiev's hierarchy of activity, actions and operations, (Figure 4) there are several groups of researchers (Kuutti & Virkunnen 1995; Hasan & Gould 2001, Engeström 1999) who use frameworks of interrelated activities to represent complex organisational situations as shown in Figure 5. Taken together the three aspects of human activity will be used to analysis and present the case described in the following section of the paper.

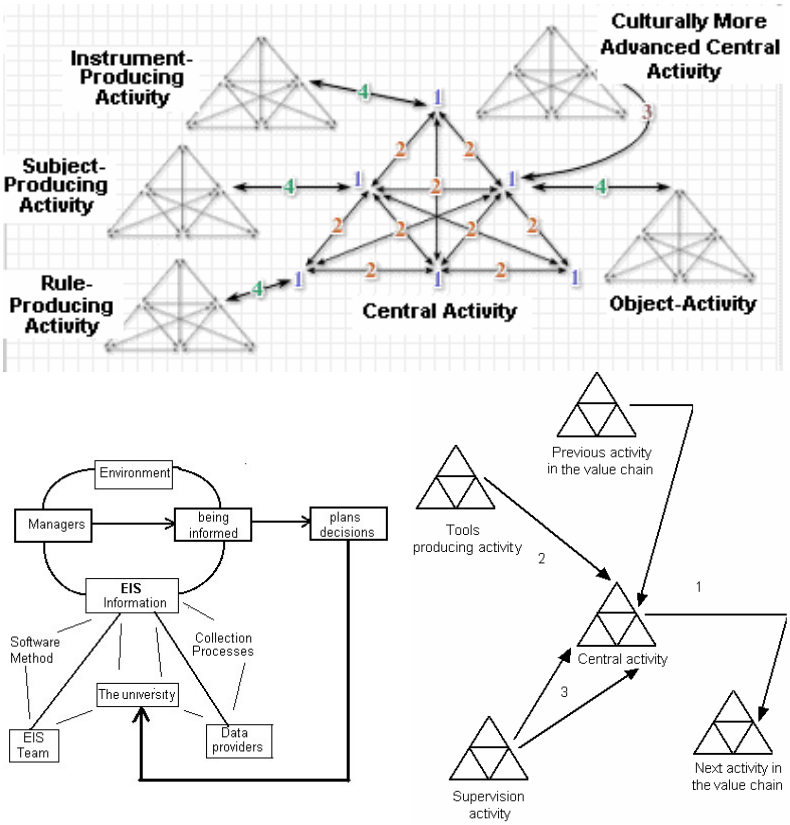

Figure 3. Sets of interrelated activities in the research of Engeström (1999), Hasan & Gould (2001) and Kuutti & Virkunnen (1995)

The following section of the paper describes research involving the support, of a specially-designed ICT system, for a number of community-oriented endeavours, which are analysed as activity systems.

4 The Research Project with Case Studies

4.1 Project Background

New information and communications technologies promise to overcome the “tyranny of distance” that besets many sparsely populated regions of the world, such as non-urban Australia. Easy access to education, employment, health and other basic facilities, that are taken for granted in the major cities, has always been a challenge for those residing in smaller towns hundreds or thousands of kilometres away. These challenges exist in widely scattered and diverse townships, but many of these communities have similar problems, with potential solutions that are not well understood by centralised government and big business decision-makers. Innovative, workable and low-cost solutions to regional concerns could potentially be generated if those in dispersed regional areas shared their knowledge, experience, expertise and

resources. The opportunity to collaborate effectively across vast distances is now enabled through digital networks.

4.2 Research method

In searching for research methods appropriate to the study of dynamic, self-organising and diverse communities through the development of complex and evolving socio-technical systems, the author is in accord with the notion of a “New Scholarship” (McNiff 2000) where there is a new way of knowing that meets the everyday needs of people working in real-life situations. Real-life practices are messy, uncontrolled and unpredictable and are seriously separated from the sanitised world of abstract theorising. McNiff (ibid) proposes that learning from experience, although not highly valued by the academy, can be reinforced through intellectual study and contrasts this to traditional forms of scholarship, which values facts and information and is generated by conventional kinds of research which tests knowledge against standardised criteria of hard scientific analysis and techniques.

The approach to this research is rooted in reflection-in-action, which implies that the research will be participatory, evolutionary, contextual, holistic and developmental. The developmental research method is a disciplined investigation conducted in the context of the creation and implementation of a product or program, in this case a socio-technical system and model, for the purpose of improving either the thing being developed or developer. It is holistic, contextual and evolutionary, where a prototype model is constructed, used with the target group, which is analysed through participatory observation before the prototype (both technology and social system) is revised.

This approach is influenced by the expanding spiral of learning in the developmental work research (DWR) approach (Engeström 1987), where communities of learning and practice are viewed as activity systems (Virkkunen & Kuutti 2000). DWR provides a dynamic framework that can accommodate a multifaceted analysis of the community members, their motives and purpose for belonging, their relationships within the community and the tools that mediate community activity. In this research the tools include technology together with social and learning processes. Discipline is imposed on the investigation by the analysis of each case as an activity system, in the tradition of the Cultural-Historical Activity Theory so that an activity system the unit of analysis is the work activity itself, which is culturally and historically located. The work/learning activity system is comprised of the following components:

- the purpose to which members of the community direct their activity
- individual workers/learners, their colleagues and co-workers/learners
- the conceptual models, tools and equipment they use, and
- the rules, culture and context that govern how they work, and learn through their work

The evolution of each community is studied with this as a framework for evaluation by the participant observers who become significant members of the community.

4.3 Evolutionary Development of the Research

This study has adopted a special purpose groupware application, UniLinks[1], which has been treated as an evolutionary prototype incorporating enhanced features for identity, group communication and support, with feedback from the research. A cross-disicplinary team undertook the work, and continued with the evolutionary development of the system during the conduct of the research. The software package allows members to register in separate teams with their own team space for asynchronous individual messaging and group discussions together with team space to sore documents. The system includes facilities to support social issues of team processes with guidance on team rules and roles and continues to evolve with feedback from the project.

The knowledge gained from each community established on the groupware system has led to more sophisticated requirements for an online support tool appropriate for a wide range of such communities in a variety of settings. For example it is particularly important to note that many have very low bandwidth access to the Internet and even intermittent access. It becomes more and more apparent how important it is to continually improve the system, based on observations, so that it is simple and intuitive to use by a wide variety of participants.

From the research perspective it has been particularly interesting to see which activities are sustained, why, how, and with what outcomes, noting contributions of the technology to the sustainability of the community activities and which facilities of the system are found usable and used most effectively. Also recorded are aspects of the social dynamics that appear to influence the behaviour of the community.

[1] Copyright © 2002-2003 K-Grid

4.4 The Multifacted, Socio-Technical Approach to Community

All the community activities in this research were inspired by an exercise in experiential, team-based learning that had been successful in creating awareness of the new science of Photonics amongst communities of high school students and teachers in a large city. In this initial project, scientists, business developers, teachers, technologists and business people contributed to three phases of the community:

- Intensive workshops with input from all participants and including community-building exercises and heterogeneous project team formation. Their project was to create a website that could inform other students about Photonics.
- An online period of sustained creative activity as new materials are assembled and knowledge is exchanged by the teams online. A proprietary web-based message, discussion and document storage system was used for this.
- Community celebrations where young people show their creative work and explain their new learning and interest to members of the community including politicians, local government officials and the media.

This experience was encapsulated in a socio-technical model for online communities, which begins with a face-to-face workshop followed by a period online where learners, experts and instructors are linked by a very early prototype of the special-purpose, Internet-based communication and group-support package shown above. During this period the community of learners undertake a team-based, problem-solving project where experiential learning takes place through the generation of skills, ideas and solutions. Periodic face-to-face celebrations of achievement are also an integral part of the model.

A developmental research investigation was conducted using this model in three regionally based communities. The aim of the subsequent stages of the research was to evaluate the contributions to the achievements of the community of the socio-technical model just described. To this end a single day workshop was held to establish and build each community and to determine what would be achieved and how. The prototype of an online support system was constructed modelled on the proprietary one used in the city-based Photonics project. Teams were established to work together in an extended online period on appropriate project designed to facilitate the desired outcomes. In the first two cases there were specific learning outcomes, the result of which were presented at a concluding half-day celebratory meeting.

4.5 The Case Studies

The first of these new communities was set up to promote awareness of the science of Photonics in a regional high school so that, although the object of the activity was the same as that of the previous city communities, the site of the activity had moved into the rural setting with the community based in a single small town. An initial face-to-face day workshop was held with the researchers, students, teachers and parents with the Photonics experts in the city joining via video-conference. Teams were formed to work together online over several weeks to find out more about Photonics and produce innovative websites to inform others. Several of the student team projects were highly successful, and made a profound impression on teachers, parents and local dignitaries who attended their celebratory final session. However, despite initial interest from teachers and parents, it was mostly the students in the community who kept the work going. Online communication was used mainly between the students and the coordinators at Photonics as the students, being in the same school, could meet face-to-face. Use of the online system was further restricted by the poor Internet facilities available to the regional participants and some shortcomings in the software.

In the second of the communities, the activity was expanded to incorporate a different purpose: an introductory course in Information Systems. This was also conducted through experiential team-based learning but with a more geographically and demographically distributed community membership involving high school students, teachers, and community seniors in several disparate regional towns. More use was made of online communication, as most members were separated by some distance and could not meet. Although some participants left the community, several teams worked together well and produced good learning outcomes.

Although these two communities were set up particularly for the research project, they were each a response to a real need in a rural setting and were an adaptation of the model used on similar projects in an urban environment. There was reason to conclude that new information and communication technologies were the catalyst to form and sustain these heterogeneous communities where it was imperative to share knowledge and skills. In a review of the projects at this stage of the research, it was determined that improvements were needed to the software prototype, the procedures for team-building and some more work was needed to find ways of sustaining interest in the community. These recommendations were incorporated in the third community of the project as will now be described.

In this stage, the research expanded in scope to study an existing distributed community with a need to use advanced technological communications to work and learn together effectively. The knowledge gained from the two previous learning communities led to more sophisticated requirements for an online support tool to make it robust and appropriate for a wide range of such communities in a variety of settings, many with very low bandwidth access to the Internet.

To this end a new UniLinks software prototype (Figure 6), incorporating enhanced features for usability, security and, performance, was built. A more professional development team than the previous one was engaged, with a leader who could continue with the evolutionary development of the system during the remainder of the research. The software package at this stage provides four levels of participation from super-user to guests and enables the establishment of many communities within which there can be many projects and within those teams. Each community or project can have its own functions of News, Forum for discussion, Storage of documents and Polling. There is a messaging system and most parts of the system are customisable. Anyone can register into the system but must be assigned to communities, projects and teams by a super-user.

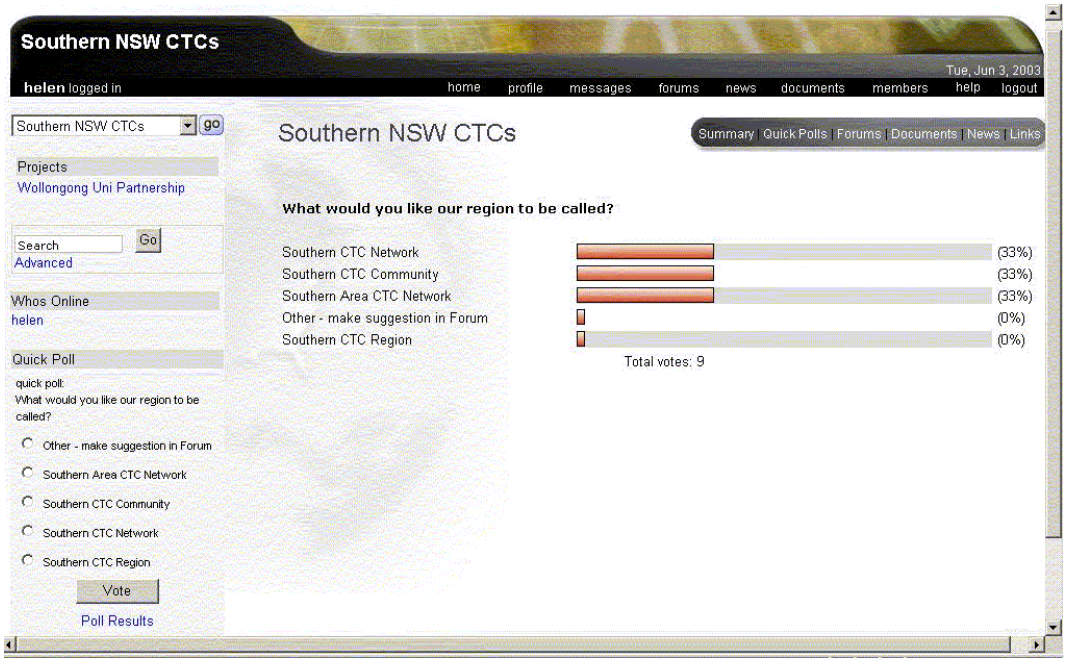

Figure 6 The version of UniLinks used with the third case study

This stage of the research involved an existing working community, a group of regional coordinators of CTCs (Communities Technology Centres) in nine towns of regional southeast Australia. The CTCs are a government-funded initiative to provide IT

services and training in small towns. This group, many of whom did not know one another, met at a two-day workshop where the researchers introduced the notion that they were a community with common interests, problems and goals and that they could build a community of support, which could continue online, using the UniLinks software.

Members of this community were highly motivated to cooperate with one another by their feeling of isolation and recognition of how they could help one another by maintaining contact online. At the initial workshop it was obvious that there was no competition between the members and that they could all see the benefits of a collaborative environment. Being computer literate, they were all excited by the UniLinks package and they were quick to see how it could be used to sustain the community. In this reasonably homogeneous community there was no attempt to set up a specific experiential learning project, although they have already created some projects of their own in the three months since the workshop. They have thereby increased the viability of their Centres by working together.

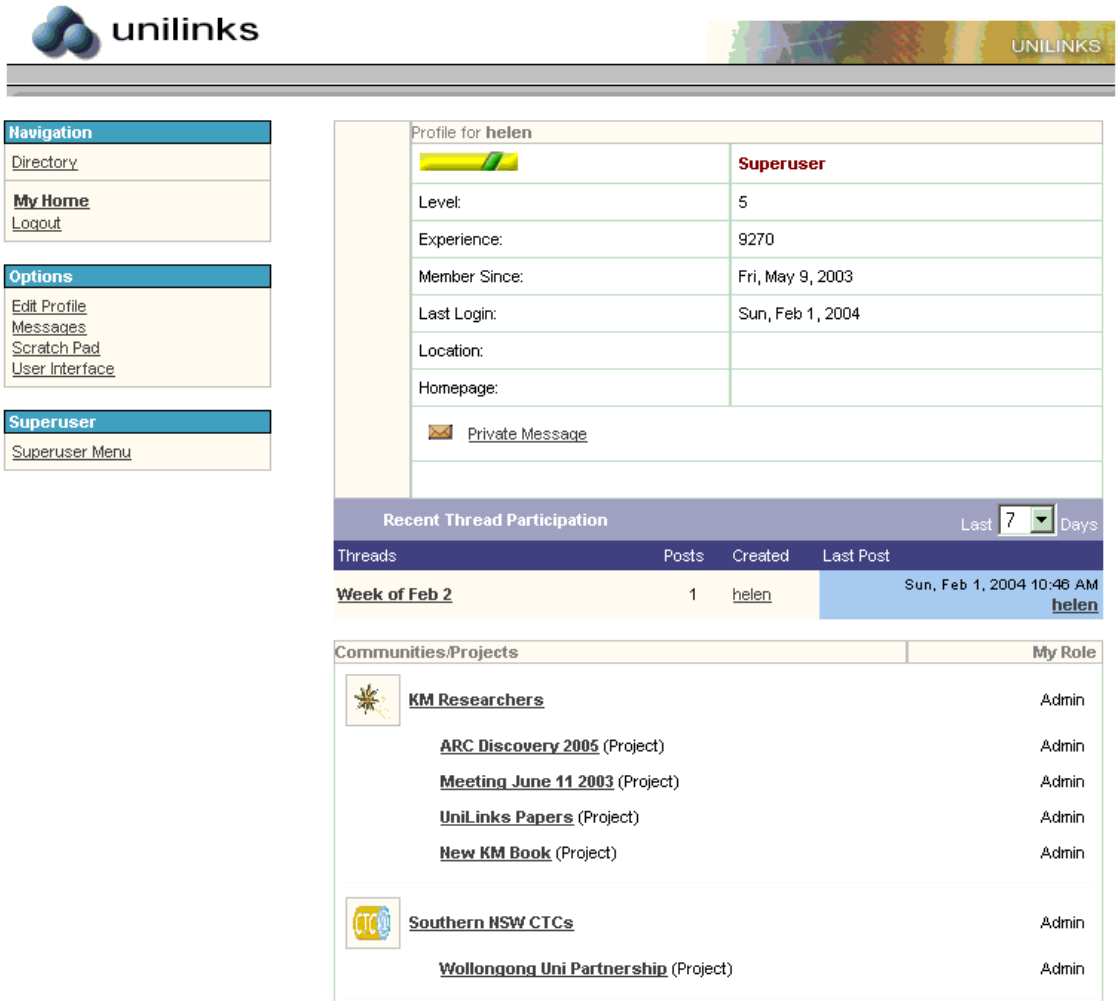

Figure 7 The current version of the UniLinks software.

The most recent case study involves the coordination of a national research network of in the field of Information Systems where research groups at widely dispersed institutions. The aim of the network is firstly to increase their awareness of each other's topics, expertise and resources not only internal but also to promote the discipline externally. It is also hoped that the network will facilitate growth in collaborative and cooperative projects, as synergies are uncovered. This network is using a new version of the groupware seen in Figure 7.

This revised version of UniLinks has resolved three dilemmas that have become apparent during the case studies.

- The first of these dilemmas concerns entry into the system, particularly when it holds several communities. Some users are members of multiple communities, whereas others are members of only one and are confused by the existence of others. The new interface provides for optional entry points, at either the top level or directly into a particular community giving much more flexibility in the user's view of the whole, and of parts of the system.
- The second dilemma is concerned with the advantages and disadvantages of separating the system and its communities from other activities of the user. The feeling of community is enhanced when the system is not integrated into the user's normal email and other everyday applications and yet there are benefits from not isolating it completely from the user's field of view where there is a risk that community engagement is neglected. This version of the system retains its discrete structure yet regularly prompts or updates users through their regular email, a facility that users can switch off if they want.
- The third dilemma, addressed in the latest version of UniLinks, is the arrangement of sub-community units. In previous versions there was a hierarchical structure of teams and, within them, projects. Associated with this structure were four levels of access, namely: super-user, community administrator, member and guest. Now the structure is flatter so that teams and projects are both direct sub-units of communities giving greater flexibility for teams or project to emerge from the cohort of community members as needed. All community members now have the ability to form teams and projects.

5 Discussion

There are a substantial number of studies into the characteristics and viability of online communities. These studies typically focus on sustainability as well as on comparisons between the ability of members to accomplish tasks online, as opposed to offline. The issues that are of significance in these types of studies are various aspects of technical facilities and capabilities, the differences between the effectiveness of synchronous versus asynchronous communication, as well as social attributes such as identity, trust and awareness in the online environment. Indeed when analysing the data from the communities described above, issues such as these could be addressed. These communities could also be analysed as spaces (ie ba's) for knowledge creation as in the work of Nonaka or as Wenger's communities of practice. However, as described in section 2 of this paper, the author has chosen, for reasons already outlined, to analyse the communities as activity systems where the CHAT concept of activity is the unit of analysis.

This discussion will focus on the following two dimensions where CHAT adds value to this study:

1. identifying all activities, together with their components and interrelationships, to give a holistic, systemic explanation of the functioning of each community.
2. employing the concept of mediation to describe the dynamic relationships between tools and the activity they support, as well as between community purpose and individual motivations in activity systems.

5.1 The Activities

In each of the cases described above, there is an interaction of two main activities – one is the research activity and the other the activity (or activities) of the community being studied. Both are innovative socio-technical systems, involving groups of workers and learners acting as a supportive community environment and enabled by new information and communications technologies. Activity Theory provides a rich, holistic understanding of how people do things together with the assistance of sophisticate tools in complex dynamic environments where socially-constructed, collective knowledge is the predominant source of learning, creativity and innovation. A CHAT analysis begins with a description of the elements of these activities and the relationship between them.

As is common when action research methods are used, the author is a subject of both activities but there are other subjects of only one activity, i.e. there are other

researchers and other members of the communities. The key element of differentiation between these two activities is their object or motive. The purpose of the community is markedly different from that of the research. For the community itself, the achievement of its goals, efficiently and harmoniously, may be of paramount importance whereas it is often the unusual, even lack of progress and disharmony that provides interest for the researchers.

As already stated, the research is interested in both social and technical tools for community support. In the technical area, the ICT system is a tool that benefits both activities but is used in different ways. The researchers collect a large quantity of rich data, to analyse in electronic form, from the community postings and discussions. In exchange, communities who agree to participate in the research are given free access to the technology as well as training from the researchers on the skills needed for successful online participation. Several groups, associated with the research, have attempted to set up communities of interest on this ICT system, and others such as Yahoo groups, and have found that without the initial face-to-face workshop they are not sustained or successful. Initial analysis indicates that the most important aspects of these workshops is the guidance of group-members in the social determinants of successful communities and in the establishment of small teams with purposeful projects for ongoing actions of the group activity.

Once the activities in an activity system are identified and their components understood the next step is to look into the relationships between activities. Examples of research into relationships between activities are shown Figure 3. The first is Engeström's well known representation of a typical Activity Systems where there is a central activity related to a set of other activities in a dynamic context. Engeström sees contradictions both within and between activities as the triggers for growth in a cycle of expansive learning as shown in Figure 2. This cycle of expansive learning is the basis of the developmental work research approach (Engeström 1987) that has determined our research approach.

This expansive cycle incorporates the CHAT concepts of internalisation and externalisation in a collective sense and hence is related to the creation of community knowledge. In CHAT internalisation is manifest in the reproduction of culture by socialising and training individuals to be members of the activity system. Creative externalisation is seen in innovations with the design of new artefacts and transformations of structure and process. (Engeström 1999)

In the research described in this paper the relationship between the research and community activities demonstrates the cycle of expansive learning in a somewhat somewhat recursive manner. The communities being studied act as a tertiary tool for the research activity while the research activity is developing social understanding and the technical system as tools for the communities.

5.2 Mediation

As already stated, an activity is defined by the tool-mediated relationship between subject and object, ie between the doer and their purpose. The mediation is a mutual development of both the activity and the tools which including primary (physical) tools, secondary tools (ideas, models etc) and tertiary tools, such as the community within which the activity takes place. The capability and availability of tools, mediates what can be done in the community at all three levels. At the primary level, new web-based ICT systems frees members of communities to communicate and work together independent of the restrictions of time and space, the latter being particularly significant in a large, sparsely-populated country like Australia. The development of workable models, such as those of online communities of practice, are secondary tools that benefit the ways communities perceive their potential. Mature communities are tertiary tools that provide environments and ecologies in which aspiring communities can grow. At each of these levels the tool develops and evolves through its use in the activity. At the primary level the ICT tool, UniLinks is continually being adapted with feedback from results of the data analysis and observations during the research. Similarly the research findings are improving a secondary tool, i.e. our multifaceted model of communities. As more communities mature, so does a larger community of experienced online practitioners grow, forming an environment, or tertiary tool, for the whole activity system. This is reinforced by the way governments at all levels are becoming involved in the process of creating the infrastructure for such communities as they recognise their contribution to national prosperity.

5.3 Conclusion

Recognising the close association between knowledge and activity through the CHAT lens, this research is studying the development of real distributed communities to discover how to create socio-technical knowledge management systems that genuinely promote learning as they increase an individual's, or group's, capacity to take effective action. In particular, it shows how new ICT systems, together with appropriate social understanding, can evolve to mediate and support the joint adaptive needs of people

dealing with complex and changing settings. This applies not only to communities in the civil society but also in the workplace and in formal learning institutions.

6 References

AA (1999) On-Line Communities in Business, *Report from the On-Line Communities Research Study*, Arthur Anderson, available from the author.

Alberts D. Gartska J. Stein F. (2000) Network-Centric Warfare: developing and leaveraging information superiority. CCRP Publication Series US DoD.

AS5037(INT)-2003 *Interim Australian Standard – Knowledge Management*, Standards Australia, Sydney.

Blackler F. (1993) Knowledge and the Theory of Organisations: Organisations as Activity Systems and the Reframing of Management. *Journal of Management Studies* 30/6 863-884.

Boland R. and Tenkasi R. (1995) Perspective Making and Perspective Taking in Communities of Knowing, *Organisation Science* 6/4 350-372.

Engeström Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.

Engeström Y. (1999) Innovative Learning in Work Teams: Analysing Cycles of Knowledge Creation in Practice, in Engeström Y. Miettinen R. Punamaki R. eds *Perspectives on Activity Theory*, Cambridge University Press, Cambridge UK.

Hasan H. (1999) Integrating IS and HCI using Activity Theory as a Philosophical and Theoretical Basis, Australian Journal of Information Systems 6/2 44-55

Hasan H. and Crawford K. (2003) A multifaceted approach to distributed communities of learning and practice. *Proceeding of the IS Perspectives and Challenges in the Context of Globalization Conference*, Athens, June 2003 for IFIP WG 8.2 and WG 9.4.

Hasan H. and Gould E. (2001) Support for the Sense Making Activity of Managers, *DSS Journal, special issue on Knowledge Management*, 31/3 71-86

Kaptelinin V. (1996) Activity Theory: Implications for Human-Computer Interaction in B.Nardi Ed *Context and Consciousness:* MIT Press, 103-116

Kurtz, C. F.; Snowden, D. J. (2003) The New Dynamics of Strategy: sense-making in a complex-complicated world, *IBM Systems Journal*, Fall 2003

Kuutti K and Vikkunen J (1995) Organisational Memory and Learning Network Organisation: the Case of Finnish Labour protection Inspectors, *Proceedings of HICSS28*.

Lave J. and Wenger E. (1991) *Situated Learning: Legitimate peripheral participation*, Cambridge University Press, Cambridge, UK.

Leontiev A.N. (1981) *Problems of the Development of Mind* Moscow: Progress

Linger H. and Warne L. (2001) Making the Invisible Visible: Modelling Social Learning in Knowledge Management Context., *Australasian Journal of Information Systems Special Edition*, 56-66.

McNiff J (2000) *Action Research in Organisations*, Routledge, London

Nonaka I. (1994) A Dynamic Theory of Organisational Knowledge Creation, *Organisation Science* 5/1, 14-37.

Nonaka I. And Konno N., (1998) The concept of "Ba': Building foundation for Knowledge Creation. California Management Review 40/3 Spring 1998.

Nonaka, I. (1998), The Knowledge-Creating Company, *Harvard Business Review on Knowledge Management*, Harvard Business School Press, Boston.

O'Donnell D., Porter G., McGuire D., Garavan T., Hefferman M. and Cleary P. (2003) Creating Intellectual Capital: a Habermasian Community of Practice Introduction, *Journal of European Industrial Training*, 27/2 80-87.

Toulmin S. (1999) Knowledge as Shared Procedures, in Engeström Y. Miettinen R. and Punamaki R. eds *Perspectives on Activity Theory*, Cambridge University Press, Cambridge UK. Pp 70-86.

Virkkunen J. and Kuutti K. (2000) "Understanding organisational learning by focusing on 'activity systems'", *Accounting, Management and Information Technology* 10 291-319.

Vygotsky, L.S. (1978) *Mind and Society*,: Harvard University Press, Cambridge, MA

Wenger E. (1998) *Communities of Practice*, Cambridge University Press, Cambridge.

Wenger E. McDermott R. Snyder W. (2002) *Cultivating Communities of Practice*, Harvard Business School Press, Boston.