

A Knowledge Management Approach to User Support

R. T. Jim Eales

School of Information Technology
Deakin University
Burwood, Victoria, 3125, Australia.

jimeales@deakin.edu.au

Abstract

This paper considers the problem of computer user support and workplace learning in general. Theoretically our work is influenced by ideas on knowledge management, expertise networks and communities of practice. Our approach seeks to tap into the powerful and situated learning potential of the collaborative support provided by colleagues. We consider that such support could be enhanced through the use of a collaborative support system. We outline our investigations into design issues, a generic model and various experiments related to the development of such a system. In particular, we emphasise the value of recorded demonstrations for representing computer-related practice. We present a number of design conclusions derived from our experiences, and warn that whereas active user participation is the essential ingredient in a support system it is perhaps the most difficult thing to achieve.

Keywords: User support, communities of practice, collaborative support, recorded demonstrations.

1 Introduction

This paper is ostensibly about user support and user learning. However, although we see the development of computer-related skills as an increasingly important area for organisational productivity, we also see it as a specific instance of a much wider research issue, the development of technological systems that support *knowledge management* (Davenport & Prusak 1998). Knowledge management considers how organisations can effectively manage, store, retrieve and augment their intellectual assets. However, Bannon & Kuutti (1996) argued that organisational knowledge should not be thought of as some static repository but as an active, constructive process related to work activities. Ackerman et al. (2003) have recently argued that we need to move beyond knowledge management to “sharing expertise”. Our particular approach is heavily influenced by the related idea of communities of practice (Wenger, 1998). We will outline these theories in more depth in the next section.

This paper outlines our particular approach to user support and workplace learning and summarises our research to date. Our general ideas and specific investigations are expressed in terms of the gradual conceptualisation, design and development of a *collaborative support system*. This is a network-based system designed to facilitate and augment the provision of collaborative support for the solution of, in this case, computer-related problems and the general development of computer skills amongst end users. Collaborative support or mutual assistance is the learning support provided by work colleagues and friends, normally operating at an informal level. Our aim is to outline and investigate the fundamental processes involved in collaborative support and the principal design issues of a generic collaborative support system, independent of system level specifics. Our work is related to work on group and organisational communication systems (see Ackerman & McDonald, 1996; Erickson et al., 2002).

The structure of this paper follows a general to specific development of our arguments. We begin by discussing general theoretical influences followed by general design heuristics in the outline of a collaborative support system. We briefly describe our model of such a system and go on to describe in some detail our investigations into recorded demonstrations as a basis for representing computer related practice, and end with a number of design conclusions

2 Communities of Practice

As computer-based tools become increasingly more complex and multi-purpose, the skills required from users become increasingly more specialised and situated. User support is generally based on a learning model emphasising the transmission of objective knowledge into the heads of individual users, sometimes termed the transfer or conduit model of learning. In other words, this approach attempts to convey “correct” knowledge about the system to individual computer users by on-line assistance, printed documentation or sometimes training. Attempts to improve user skill levels generally focus on trying to improve these methods of user support. To expect computer users to develop these skills individually, generating their situated understanding from universal instruction is unrealistic. Of course, users do not develop these skills in isolation, they invariably make use of informal collaborative opportunities to develop their situated expertise; a point rarely discussed in user learning and rarely exploited in user support. We believe that collaborative workplace learning has the potential to make a significant contribution to computer-related skill

development and to organisational productivity in general, particularly with the right kind of organisational and technical support. Our aim is to investigate and define what constitutes the right kind of support.

Our approach to supporting computer users is strongly influenced by social models of learning and ideas on communities of practice. A *community of practice* is an informal but committed group of people that supports the sharing and development of expertise in some specific area. The notion of a community of practice is ancient. It taps into traditional human methods of passing on knowledge and skills (often effortlessly) within cohesive groups. This model of learning is reflected in traditional methods of apprenticeship. The general idea of a community of practice was revived in modern learning discourse by Lave and Wenger (1991). The idea has had little influence in formal education but has been adopted with vigour by the business sector (for example, Brown & Duguid, 2000; Wenger et al., 2002).

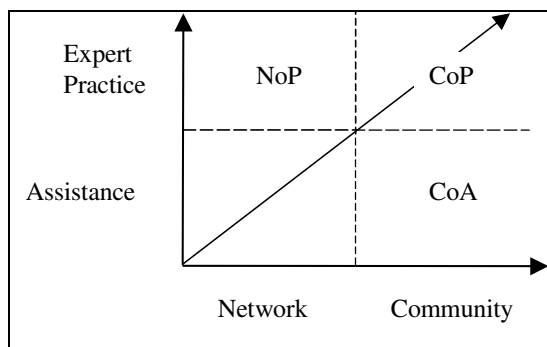


Figure 1: The development of communities of practice.

We can conceptualise the development of a community of practice as requiring both a sense of community (commitment, cohesion, trust, understanding, etc.) and ready access to a range of expert practice (see Figure 1). We describe the lesser state of community as a network and the lesser state of expert practice as assistance. Our research into informal collaborative support amongst computer users found that many groups could more accurately be described as communities of assistance (CoA) rather than communities of practice (CoP). In other words, they had a definite sense of community but they lacked the necessary access to expert practice. We can also conceive of groups, networks of practice (NoP), that have a range of expertise but lack the necessary sense of community to facilitate the sharing of this expert practice. The technical augmentation of CoA's to create CoP's has become our principal research focus. However, in our attempt to facilitate access to expert practice we have to be careful we do not undermine the essential sense of community.

3 Augmenting Communities of Practice

Communities of practice utilise powerful natural collaborative learning strategies. Although these "natural" learning strategies are a valuable resource they may not necessarily be very efficient or lead to optimal performance. We believe appropriate technological

support can tap into these powerful forces while affording opportunities to extend the quality and the extent of the learning. Needless to say, the technological support of informal learning involves the subtle interaction of many complex factors. We begin our investigation by highlighting what we believe are three of the most important design issues involved in the technical augmentation of informal learning.

3.1 User motivation

During end user skill development, computer use often tends to plateau at a sub-optimal level. Users generally adopt conservative learning strategies during this period, actively resisting new learning. Given such a situation, how can we motivate users to learn new skills? Computer-related problems that disrupt the normal flow of work may represent valuable opportunities for learning new and more optimal methods. These problems can be interpreted as examples of what Winograd and Flores (1986) term *breaking down*. They suggest (borrowing from Heidegger) that a tool, like a hammer, to the person hammering does not, as such, exist. "It is part of the background of *readiness-to-hand* that is taken for granted without explicit recognition or identification as an object". A hammer only presents itself as a hammer when there is some kind of breaking down or *unreadiness-to-hand*. Breakdowns in otherwise habitual practices represent opportunities to reflect on practice and to develop more optimal or efficient forms of practice. To take advantage of these breakdowns to introduce more optimal computer use we require a system of support that is both timely and situationally relevant.

3.2 User effort

It has often been said to us that the flaw in our argument for collaborative support systems is that if users are unwilling to expend effort to learn to use their computer-based tools in the first place, why should they expend additional effort mastering the use of another system. Our approach is based on tapping the inherent learning potential of mutual assistance, often initiated by problems occurring within a cooperative context. We see this as a valuable and powerful learning resource that can be harnessed and optimised with the addition of appropriate technological support. An important design heuristic for us is to focus on minimising the amount of user time and effort required to provide collaborative support while maximising the value of the support provided.

3.3 User sensitivity

A collaborative support system has to deal with a number potentially very sensitive issues related to the visibility of the way people work and their need for help. Workers may be sensitive about the particular way they do things and about asking for help, even amongst their peers. Computer users may be quite aware that they use sub-optimal methods to perform common computer-based tasks, but do not want this fact broadcast to all and sundry. Revealing ignorance to work colleagues by asking for help can be a difficult and painful process. People generally do not want their ignorance (real or

assumed) exposed for all to see. User fears may be greatly increased by the prospect of management monitoring of collaborative support systems. We believe that a significant design heuristic should be the ability for users to be able to control visibility within a support system and that they should have confidence in the security of visibility boundaries. Insensitive technological design can easily discourage the use of computer-mediated channels to seek assistance. The most promising approach to these three complex but critical design issues would seem to be a sensitive, exploratory and participatory approach to design combined with a restrained and minimalist use of technology.

4 Our Research

To date, our practical research investigations and interventions relating to the design of collaborative support systems, although extensive, have been somewhat fragmented and opportunistic. Because context is vital in our research, we have had to make use of “authentic” situations as they became available. Our research is given coherence and consistency by our underlying theory of learning and our long-term commitment to the exploration of the fundamental relationship between learning and technology. Our studies can be divided into two broad areas of investigation, the study of mutual assistance in the workplace and the study of the application of technology to collaborative learning.

5 The Study of Mutual Assistance

To investigate computer user learning strategies we undertook a detailed study of computer use and skill development amongst end users (Eales & Welsh, 1994). We observed and interviewed workers in five different administration departments of a major university. We found that end users receive very little training and that they tend not to use printed documentation or on-line help to develop their computer skills. Fortunately, in their efforts to come to terms with the understanding involved in computer use the worker is rarely alone. He or she shares many of the situational factors of computer use with fellow workers. We found overwhelming evidence to suggest that the assistance of co-workers, and sometimes other people in an organisation, is a highly valued form of computer support and is the most common method of support for solving computer-related problems.

It would appear that the existence of a social collaborative support network encourages the development of distributed expertise. On the other hand, the development of distributed expertise reinforces the advantages of collaboration. If obvious expertise in an area does not exist or is not readily available people with the same or similar problems generally find it advantageous to pool their efforts to reach a solution. We are not suggesting, however, that collaboration is easy to establish and develop, or always necessarily effective.

Our emphasis has moved on from proving the existence and importance of mutual assistance to modelling the

form and nature of these relationships. In particular we are looking at:

- the relationship between support networks and perceived expertise within workgroups
- the relationship between informal and formal (or semi-formal) methods of support within an organisation
- collaborative support relationships that cross workgroup boundaries
- the part played by existing technology in collaborative support relationships

6 Designing a Collaborative Support System

Our studies of mutual assistance or collaborative support in the workplace have always been focused on issues relating to the design and implementation of technically-mediated support systems.

6.1 Collaborative visibility

We believe that an important method of supporting skill development amongst computer users is to make computer-use more *visible* within a collaborative context. We want to turn *individual* dilemmas associated with computer use into *collaborative* learning opportunities. That is, if technology could make computer-related practice more visible within workgroups, this would have a positive effect on the development of computer skills. We term this design principle *collaborative visibility*.

Hutchins (1990) has warned that normally public but “invisible” activities are particularly vulnerable to the introduction of new technology based on narrowly defined specifications of processes. “Technology has a key role here because the horizons of observation of the members of a work group are often defined by technology” (p. 215). When areas of collaborative working are computerised, the new technological system often excludes many seemingly trivial but vital aspects of the previous work practices. These “trivial” aspects are often vitally important habitual practices and tacit understandings that people take for granted and are rarely aware of. Hutchins (1995) has also drawn attention to what he terms *open tools*, such as navigation charts. He suggests that the design of tools can affect their suitability for *joint use* or for *demonstration*. When a person is performing some activity, the interaction between that person and a tool may or may not be open to others depending on the nature of the tool. Open tools provide opportunities for the observation of tool use and can contribute to the general spread and development of practice. It has to be said, however, that desktop computers are not inherently open tools but are largely private tools - it is not easy to observe the interaction of a user and a computer other than in a very trivial way.

This privacy of practice is the prevailing situation in most workplaces where computers are used. To illustrate this, we once interviewed an apparently experienced computer user who had never discovered that word processors allow the user to copy between documents, even though this person worked in an office with several others. When this person wanted to copy a section from one document to another they printed the first document out

and then typed the section again working from the hard copy. Our goal is to make private tools into open tools. We are attempting to make computer use and computer skills more visible within a collaborative context. We consider the commitment, mutual understanding and mutual assistance inherent within cooperative workgroups to be a valuable resource for workplace learning. From this perspective, sub-optimal utilisation of computer tools can be interpreted not so much as a reluctance to learn, but more as *isolation* from more knowledgeable practice.

6.2 The MutualAid Model

Drawing on the notion of collaborative visibility we have developed a generic model of a collaborative support system that we term *MutualAid*. Our design is based on a simple MutualAid conceptual model: a cyclic process of capture, sharing and discussion with storage occurring as a subsidiary activity. Computer-related problems, solutions, general information and the discussion process are captured in various ways. Information generated outside the group, perhaps communicated via a wider organisational support level, may also be made available. These various representations are made visible within the support group by the MutualAid system. We have derived a MutualAid functional model from the conceptual or process model. This functional model consists of three elements:

The recorder tools. These are various computer-based tools utilised by the users to create representations of practice.

The forum. The forum is the place where problems, solutions and general information are made visible or public within the support group. It also supports general group interaction which is a vital part of sharing and developing skills and knowledge.

The memory. The memory provides a permanent record of representations of local practice built up during the continuous process of support.

6.3 Recorded Demonstrations

A collaborative support system is user-driven. It has no influence on user skills whatsoever unless it is actually used, but more importantly it relies on the active contributions of participants for its creation and development. This approach changes the emphasis of design away from issues such as the specification, categorisation and provision of information *for* users; towards issues relating to the provision of tools and facilities for capturing, sharing and organising representations of local practice *by* users. The design of user support becomes less concerned with what representations of practice should be and more concerned with facilitating the process of sharing representations of practice, whatever they may be. This has meant that a great deal of our research effort has been focused on finding a suitable method of capturing practice.

Generally, text is not a good method of representing computer-related practice. Ask a colleague how to do something using a computer and they will invariably demonstrate it to you. Within a situated and collaborative

learning paradigm the demonstration can be a very important method of communication between users about the way to do things with a computer system. Within our MutualAid system the most important way of representing computer-related practice is the *recorded demonstration*. This is not a perfect or complete solution to representing computer-related practice but it does appear to fulfil our design heuristic of minimising user effort while maximising representational value. The recording of a demonstration takes little more time or effort than it takes to give a demonstration; although there may be the necessity for a short period of rehearsal or for repeating the demonstration if something goes wrong on the first run. Providing the demonstration recording controls and the method of making the demonstration available are relatively simple, there is little additional cognitive effort involved in the creation of a demonstration. This is in marked contrast to the cognitive effort involved in trying to describe computer-based practice in text form.

The relative ease of recording a demonstration may represent something of a trade-off between representational creation and representational interpretation. Depending on the specific circumstances, there may well be considerably more cognitive effort involved in trying to interpret a recorded demonstration than in the creation of that demonstration. The visual and audio complexity that makes demonstrations a rich multi-layered representation of practice may make interpretation a difficult task. Recorded demonstrations may only have value in a cohesive support group where mutual understanding and a shared situation supports interpretation. The mutual understanding built up amongst group members over time can be a valuable resource in communication and interpretation. It makes it easier for demonstrators to understand the needs of the learners and allows the learners to more easily understand the activities of the demonstrators. The people in a support group can also be expected to use common computer-based tools, be working on similar or related tasks and to have to meet comparable standards of practice.

6.4 Understanding Demonstrations

We experimented with the use of recorded demonstrations organised into a small database in a university unit teaching "Computing Tools", designed to introduce non-computer science undergraduates to the use of a simple integrated computer application. The skills developed in this unit were very similar to those normally associated with computer use in the workplace. The principal focus of the investigation was to test the value of recorded demonstrations as a means of communicating how to perform common tasks with the software. Our experimental system consisted of 20 recorded demonstrations, typically 30 seconds in duration, representing all the commands required to be mastered for the first part of the unit assessment.

Students in one group were informed that recorded demonstrations were available on the network for their use, and that they covered all the commands that might be

assessed in the first test. Students who used the demonstrations were asked to complete a short questionnaire. We received 16 completed questionnaires. All but one of the students said that the demonstrations were a valuable preparation for assessment. They had no trouble understanding the demonstrations and some also said that the demonstrations had clarified points that they were not sure of. A number of students asked for demonstrations to be provided before subsequent assessments.

From the questionnaire results and spoken comments from students we concluded that recorded demonstrations appear to be a popular and easy to understand method for communicating computer-based skills. However, there are a number of caveats to be mentioned relating to the specific situation of the experiment:

The students used the recorded demonstration in association with textual explanations (the formal instructional notes and textbook for the unit). These notes significantly assisted in the understanding of the demonstrations.

All the subjects were undergraduates and presumably had advanced learning techniques and abilities.

Unlike in the workplace, we were dealing with a known curriculum. We were in control of the assessment procedure and could confidently produce a prescriptive collection of recorded demonstrations.

6.5 Creating Demonstrations

We also developed a prototype collaborative support system for the administration staff in one of the academic departments of a university. The members of this workgroup had recently changed from using Unix terminals to PC's, but had only received minimal training, thus creating a potential need for additional user support. Once again we focused on the recorded demonstration as the principal method of capturing and sharing practice. Demonstrations were created using Lotus ScreenCam. ScreenCam creates a "movie" file of everything that occurs on the screen during recording. Recordings can be organised so that simply clicking on an icon can activate their playing. To facilitate the recording and sharing of demonstrations we created a document that could be accessed via a local area network by any member of the workgroup. This common document acted as a repository of links to recorded demonstrations. All members of the workgroup could, and many did, add their own recordings to the collection.

This experiment demonstrated that ordinary computer users could not only understand recorded demonstrations but could also make their own recordings. However, although various users created recorded demonstrations of computer use, we cannot say that a true forum developed. The general access to the collection of demonstrations was sporadic and did not develop into a regular process of problem setting, problem solving or information sharing.

6.6 Creating a Forum

A collaborative support system operates in a socio-technical milieu. A socio-technical system has a social sub-system and a technical sub-system. Crucially the effectiveness of the complete system depends on a balance between the two sub-systems. The optimising of one sub-system at the expense of the other will result in less than optimal results from the overall system.

To expect the social sub-system of a collaborative support system to exist and flourish totally within the informal domain may well be unrealistic. One approach to the problem of encouraging active user participation may be to incorporate some semi-formal organisational recognition and assistance into the overall system. One of the university administrative departments that we studied had a number of semi-formal (non-technical) support initiatives in place:

The *local* support of computer users had the active backing of departmental management.

The department had a history of providing *local* computer support and a number of people had considerable experience in the area.

The department had a *designated support person*, external training was provided for key users and internal training for other users.

The support programme was particularly geared to the introduction of new software into the department.

The factors that influence active user participation in a technically-mediated support system are complex and subtle (see Eales & Welsh, 1995). This problem of participation appears to be very similar to the problems of user acceptance of computer supported cooperative work (CSCW) systems described by Grudin (1994). Valuable insights for the development and operation of collaborative support systems may be gained by studying successful CSCW systems in use.

7 Design Conclusions

Our various investigations and experiments related to the design of a collaborative support system have shed light on certain areas. Full and meaningful socio-technical evaluation of such a system is strongly influenced by the inherent characteristics of the specific social sub-system of its use. However, a number of conclusions, relating mainly to technical design, can be drawn from our experiences:

1. The notion of a collaborative support system based on the use of collaborative technology to support situated and collaborative learning, appears to meet a particular need for a way to share and develop computer-related practice.
2. The construction of a collaborative support system appears to be technically feasible with existing widely available software and additional simple utilities.
3. Our MutualAid functional model with its three elements: recorder tools, forum and memory, has proved a useful basis for the development of a practical collaborative support system.
4. Recorded demonstrations have proved to be a simple and effective way to communicate computer-

related practice.

5. User acceptance indicated by utilisation and participation is the paramount “social” issue to be addressed in the design of a collaborative support system. Without user utilisation and participation all other factors are irrelevant.

8 Future Work

8.1 Organisation of Memory

In our consideration of support for computer skill development we have deliberately emphasised a learner-centred and user-driven view of the sharing and development of practice. This is in marked contrast to a view of support emphasising the provision of universal knowledge to individual learners that sees learning as essentially information retrieval. Our emphasis, however, has meant that we have paid far more attention to the processes of sharing and developing practice than to issues related to the organisation of records of practice. Clearly these representations have some long-term value. Recorded demonstrations of computer-based activity might play an important part as extended memories of practice. Further research is needed into methods of large-scale information organisation and retrieval that reflect a local and learner-centred emphasis.

8.2 Learning Other Skills

Our consideration of collaborative support systems has been deliberately focused on the development of computer skills. However, as we suggested in the introduction, organisations are increasingly becoming interested in knowledge management. We need to widen the scope of our consideration of computer-based support for organisational learning to include areas of knowledge and skill beyond those that are computer-related. We believe that many of our design concepts and proposals are equally applicable to other areas of group and organisational knowledge. We need to investigate how computer-based technology can support the capture, sharing and storage of all kinds of situated practice in the workplace.

9 Conclusions

We have advocated and demonstrated a different approach to the support of end user learning based on a situated and collaborative view of learning. We have outlined the findings from our various investigations into how best to design a computer-based system to support this form of learning. We believe this approach has considerable potential for development and will lead to significant improvements in organisational computer-use and productivity.

10 References

Ackerman, M. S. and McDonald, D. W. (1996) Answer Garden 2: Merging organizational memory with collaborative help. In *the proceedings of CSCW '96*, 97-105.

Ackerman, M. S., Pipek, V. and Wulf, V. (eds.) (2003) *Beyond Knowledge Management: Sharing Expertise*. Cambridge, MA, MIT Press.

Bannon, L. J. and Kutti, K. (1996) Shifting Perspectives on Organizational Memory: From Storage to Active Remembering. In *the proceedings of the Twenty-ninth Hawaii Conference on System Sciences*, vol. 4, 156-167.

Brown, J. S. and Duguid, P. (2000) *The Social Life of Information*. Boston, MA, Harvard Business School Press.

Davenport, T. H. and Prusack, L. (1998) *Working Knowledge: How Organizations Manage What They Know*. Boston, MA, Harvard Business School Press.

Eales, R. T. J. and Welsh, J. (1994) Learnability through working together. In *the proceedings of OzCHI'94*, (Melbourne), 27-32.

Eales, R. T. J. and Welsh, J. (1995) Design for Collaborative Learnability. In *the proceedings of CSCL '95*, (Bloomington, IN), 99-106.

Erickson, T., Halverson, C., Kellogg, W., Laff, M. and Wolf, T. (2002) Social translucence: designing social infrastructures that make collective activity visible. *Communications of the ACM*, **45**(4), 40-44.

Grudin, J. (1994) Groupware and Social Dynamics: Eight challenges for developers. *Communications of the ACM*, **37**(1), 93-105.

Hutchins, E. (1990) The technology of team navigation. In J. Galegher, et al., editors, *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*, Hillsdale, NJ, Erlbaum, 191-220.

Hutchins, E. (1995) *Cognition in the Wild*. Cambridge, MA, MIT Press.

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

Wenger, E. (1998) *Communities of Practice: Learning, meaning and identity*. Cambridge, UK, Cambridge University Press.

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

Winograd, T. and Flores, F. (1986) *Understanding Computers and Cognition: A new foundation for design*. Norwood, NJ, Ablex.