Groupware support for organisational learning: Fostering knowledge dissemination through process improvement groups

Nereu F. Kock Jr.
Robert J. McQueen

Dept. of Management Systems
University of Waikato
Private Bag 3105
Hamilton
New Zealand

Home page: http://tui.mngt.waikato.ac.nz/systems\ned\ned.htm
E-mail: nfk@waikato.ac.nz
Phone: +64 7 856 2889, ext. 6056 or 4509
Fax: +64 7 838 4270
Groupware support for organisational learning: Fostering knowledge dissemination through process improvement groups

ABSTRACT

This paper presents a review of the organisational learning literature that points to process improvement (PI) groups as an appropriate tool for knowledge dissemination. Based on that review, the impact of support provided by a class of groupware systems, electronic conferencing (EC), on knowledge dissemination in organisations is examined in the context of PI groups.

Data was collected through an action research project, where the researcher facilitated 7 PI groups in two organisations with the support of an EC system implemented with Novell Groupwise, and using a group methodology for PI called MetaProi. The study suggests that, overall, EC support seems to have a positive impact on knowledge dissemination in organisations, when used in combination with a group methodology for PI. EC support effects on PI groups can be summarised as: (a) A reduction of the influence of distance and other physical obstacles to the participation of members from different departments in PI groups, and of the disruption that group discussions are likely to cause for individual group members, particularly when these members are from different departments; (b) A reduction of interdepartmental conflict obstacles to the formation of PI groups; and (c) An increase or decrease in individual learning in PI groups, depending on the complexity of the issues being discussed and the clarity of electronic contributions by members. Organisational implications of these research findings are discussed.
Introduction

Organisations generate and deliver products to fulfill the needs of their customers. This is accomplished by means of processes, which can be defined as sequences of activities carried out by functions (performed by staff) with the use of tools (Davenport and Short, 1990). Organisational processes often involve two or more departments in their execution. Therefore, process improvement (PI) efforts are likely to be best performed by groups comprising staff from different departments.

In addition, at least two factors make it desirable to have a certain degree of departmental heterogeneity in PI groups to maximise the effectiveness of these groups - i.e. the likelihood that process redesign proposals will lead to actual improvements, when the focus of improvement is on processes that involve several departments. First the knowledge necessary to generate effective redesign proposals is unlikely to be possessed by a single department or manager (Kock and McQueen, 1995; Kock et al., 1996). Second, redesign proposals are likely to meet with staff resistance if they are generated without the involvement of representatives from the departments concerned.

This study examines an often hidden benefit accruing from interdepartmental PI groups to organisations - the communication of socio-technical knowledge between departments that these groups foster, and the consequent organisational knowledge dissemination and learning - particularly regarding the effect that asynchronous groupware support has on these. To narrow the scope of this study, we targeted our analysis at the effects of the use of a particular type of asynchronous groupware technology, e-mail conferencing (EC), on obstacles to interdepartmental communication and knowledge dissemination in organisations through PI groups. Two main research questions guided us in the search for that goal:
(1) Does EC support reduce the obstacles to departmental heterogeneity in PI groups?

(2) Does EC support increase individual process-related and social learning in PI groups?

One assumption of this study is that the PI group is an effective instrument for knowledge communication and organisational learning. This assumption is based on two previous research studies: (a) A study of PI groups (Kock and McQueen, 1995), which suggests that PI groups can foster organisational learning particularly among non-management staff; and (b) A study of 22 business processes in three organisations (Kock and Corner, 1996), which showed that improvement processes carried out by PI groups had over twice the proportion of knowledge exchanges found in core and support processes. The remaining proportion of exchanges comprised data with low information content, or just information (see e.g. Kock et al., 1996 for a discussion on the distinctive nature of data, information and knowledge in organisational contexts).

Given the assumption above, then a reduction in the obstacles to departmental heterogeneity in PI groups is likely to increase knowledge communication between departments, and consequently organisational knowledge dissemination and learning. While this indicates the relevance of research question (1), it is also important to assess whether the EC mediation itself is likely to increase or decrease process-related and social learning in PI groups. Given the indication that the EC medium can increase equivocality in group communication (Daft and Lengel, 1986; Markus, 1992), EC support may be more detrimental than beneficial to PI groups. This issue is addressed by research question (2).

The research findings presented later on in this paper provide the basis for partially answering both research questions. A further discussion about the link between PI and
knowledge dissemination, which reinforces the assumption that the PI group is an appropriate tool for knowledge dissemination in organisations, is followed by a description of the research method used in this study and a description of the research findings. Some organisational implications are presented based on the research findings, particularly for the speed and breadth of knowledge dissemination in organisations.

**Process improvement and knowledge dissemination**

A climate of risk-taking and experimentation has been found to be an important factor in organisational learning. While this climate may be achieved through the adoption of new management practices and paradigms, whereby organisations can move from reactive and task-oriented approaches to more proactive and creativity-oriented ones (Nevis et al., 1995), the transferring of acquired knowledge or skills from one part of an organisation to another remains a complex and problematic issue (CHE, 1995). The transfer of acquired knowledge and skills across different organisational areas is, nevertheless, one of the most important components of organisational learning (Redding and Catalanello, 1994) and competitiveness (Boland and Tenkasi, 1995).

One of the main obstacles to knowledge dissemination in organisations is functional departmentalisation, that is, the grouping of functions into departments. However, functional departmentalisation seems to be a necessary evil, and has probably found its way since the Industrial Revolution into the 1990s due to another contemporary phenomenon - an exponential growth in knowledge specialisation (Kock et al., 1996). Mirroring organisational models inherited from the industrial revolution, organisational departments today often tend to group together staff with similar knowledge backgrounds and skills that enable them to carry out certain activities and processes better than other non-qualified staff. For example, a marketing department will typically comprise staff with a common knowledge background in marketing, whereas a R&D department will typically
involve staff with a common knowledge background in research methods and technical characteristics of the products being tested and developed.

Functional departmentalisation is typically reinforced by physical barriers, often in the form of office walls and physical distance between departmental offices. These add to the existing barriers to interdepartmental communication posed by knowledge specialisation, and the consequent reluctance of "outsiders" to try to understand the "complexity" of the internal procedures in departments. This perceived complexity prevents staff from different departments from understanding why and how activities outside their departments are performed, which often leads to the need for expensive external coordination functions. In order to reduce departmental barriers to communication and the low quality that can accrue from this isolation (Deming, 1986) several tools have been developed, particularly in the 1980s and 1990s. One such tool is the PI group.

The organisational learning research literature largely acknowledges two characteristics of PI groups as particularly useful for knowledge dissemination and learning in organisations. First, that literature acknowledges the effectiveness of small staff learning groups in bringing about knowledge communication between different departments and, in some cases, between different managerial levels (see e.g. Revans, 1991; Casey, 1993; Peters, 1996). Second, the organisational learning literature acknowledges the need for a focus on processes, as opposed to "problems", to generate more effective types of learning - for example, moving from single-loop to double-loop learning (see e.g. Argyris, 1977; Argyris, 1992). PI groups also provide a legitimate reason for interdepartmental exchange of knowledge, as organisational processes almost invariably need to undergo radical or incremental redesign in order to match or surpass quality and productivity improvements in processes of rival organisations, make use of new technologies and adapt to new government regulations (Deming, 1986; Davenport and Short, 1990; Hammer and Champy, 1993).
However, it is often difficult to bring together staff from different departments to collaborate in PI group discussions. In addition to functional departmentalisation and physical obstacles, some other reasons can account for this difficulty. Often different departments have their own social norms, which can be incompatible with those of other departments. For example, well-established social norms in a R&D department, such as flexible work times and intimacy between managers and subordinates, may conflict with rigid and hierarchical norms adopted in a production department. The different "languages" that departments may use internally, due mainly to the distinct types of expertise employed, may also hamper interdepartmental communication and organisational learning. These differences can cause communication gaps between departments that prevent the sharing of process-related knowledge and information. Our study sought to analyse the impact of EC support on these obstacles in the context of PI groups. This was done by engaging the researcher and organisational staff in collaborative business change interventions accomplished through PI groups. The following section describes the research method used to perform these interventions and, at the same time, generate research data.

**Research method**

One PI group was studied over a period of one month at School (pseudonym), a school of studies in a New Zealand university. Three months later, six PI groups were studied over a period of four months at MAF Quality Management (MQM), a branch of the New Zealand Ministry of Agriculture and Fisheries, with offices spread throughout the country. These six groups involved, altogether, forty-seven staff from eighteen different sites (known in MQM as offices and remote sites) spread over New Zealand. All seven groups, referred to as G0-G6, have been facilitated by the researcher (first author of this paper) based on a group process methodology called MetaProi (Kock, 1995). MetaProi provides a group process, guidelines and graphical tools to be used by PI groups, and comprises three main stages: (1) Process definition, where the group agrees on a process (or a few
processes) to be redesigned; (2) Process analysis, where the selected process is modelled and related performance information is gathered and discussed by the group; (3) Process redesign, where process changes are proposed and a plan for their implementation is outlined.

Main features of the groups studied are shown in Table 1, including number of members (except the facilitator), duration in days, and number of organisational departments and sites involved in each group. Typically, departments comprised staff with shared expertise on specific areas (e.g. academic department, animal analysis laboratory, farm consulting department). Sites, on the other hand, comprised staff (often from different departments) in the same building or campus. The last column in the table shows the scope of change of the redesign proposals generated by the groups, which were classified as departmental (dept.), if the redesign affected only one department; interdepartmental (interdept.), if it affected more than one department but not a whole business unit; and business, if it affected a whole business unit. This study involved two business units at MQM, and one at School. The business units at MQM were characterised by their administrative autonomy, and by being at the first divisional level within MQM.

<table>
<thead>
<tr>
<th>Group</th>
<th>Members</th>
<th>Duration (days)</th>
<th>Departments</th>
<th>Sites</th>
<th>Change scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>G0</td>
<td>7</td>
<td>33</td>
<td>2</td>
<td>1</td>
<td>interdept.</td>
</tr>
<tr>
<td>G1</td>
<td>5</td>
<td>26</td>
<td>1</td>
<td>1</td>
<td>dept.</td>
</tr>
<tr>
<td>G2</td>
<td>5</td>
<td>25</td>
<td>1</td>
<td>4</td>
<td>interdept.</td>
</tr>
<tr>
<td>G3</td>
<td>7</td>
<td>14</td>
<td>1</td>
<td>6</td>
<td>business</td>
</tr>
<tr>
<td>G4</td>
<td>11</td>
<td>29</td>
<td>4</td>
<td>5</td>
<td>business</td>
</tr>
<tr>
<td>G5</td>
<td>15</td>
<td>28</td>
<td>6</td>
<td>10</td>
<td>dept.</td>
</tr>
<tr>
<td>G6</td>
<td>14</td>
<td>10</td>
<td>3</td>
<td>8</td>
<td>business</td>
</tr>
</tbody>
</table>

**Table 1**: Features of the PI groups studied

Most of the interaction in the PI groups happened through an EC tool implemented using Novell Groupwise. This tool enabled group members to send messages to a mailbox called BPI, which were then automatically distributed to all the other members of their respective groups. The tool worked similarly to Internet distribution lists. The proportion
of overall group interaction time (calculated based on member participation times) through the EC tool varied from 67 to 89 per cent, except for G3. The remainder of the time was composed of oral one-to-one phone and face-to-face interactions. In G3, the proportion of EC interaction was only 18 per cent. The remaining 82 per cent in G3 was spent on face-to-face meetings where all group members were present. Almost no one-to-one e-mail messages were exchanged during group discussions.

Data was collected between May 1995 and January 1996 through participant observation and unstructured interviews (twelve at School, and thirty-two at MQM), structured open-ended interviews (two at School, and nine at MQM), questionnaires with open-ended questions (seven at MQM), and automatic computer generation of transcripts of electronic group discussions. All structured interview and questionnaire respondents declared having participated in face-to-face groups before, and 63 per cent in face-to-face PI groups. The outcomes of participant observation and unstructured interviews have been compiled as field notes. Structured interviews, typically one hour each, were taped and transcribed. Questionnaires were administered via e-mail to some staff at MQM who were located in remote offices and followed up with telephone interviews.

The research was designed to improve real business processes in the participant organisations, as well as generating research data, and followed a specific action research approach (Kock et al., 1995). This approach is based on the action research cycle proposed by Susman and Evered (1978). The data analysis combined quantitative and qualitative techniques (Miles and Huberman, 1994), and led to several research findings. Part of these findings are discussed in the next section, with a focus on the two research questions stated previously.
Research findings and discussion

Three main research findings are discussed in this section. The first finding, which was strongly supported by interview responses, is that EC support is likely to reduce physical distance and disruption obstacles to the formation of interdepartmental PI groups. The second finding, based on anecdotal evidence, is that EC support is likely to reduce interdepartmental conflict obstacles to the formation of PI groups. The third finding is that EC support may increase or reduce individual learning in PI groups, depending on the complexity of the issues being discussed and the clarity of electronic contributions by members. Each of these findings is discussed separately next.

EC support effects on physical distance and disruption barriers

One of the tenets of world-class organisational development approaches, such as the total quality movement, is that process quality and productivity can "always" be improved (Deming, 1986; Ishikawa, 1986; Juran, 1989). If this is true then one can have the expectation that any well managed organisation will always have a number of PI efforts under way. While our study supported the first assumption, it also indicated that the obstacles to interdepartmental PI efforts are hard to overcome. For example, whenever we approached prospective group leaders in our study, we noticed that there were always a number of problems awaiting for solution. Those problems typically related organisational processes spanning at least two departments. However, none of the staff approached was, at the time the first contact was made by the researcher, involved in any PI effort, although most of them declared being engaged in problem solving efforts at the departmental level.

As shown in Table 1, all PI groups either involved staff from more than one department, or generated changes that affected more than one department, except for G1. The initial interviews with prospective group leaders clearly indicated that the problems tackled by
EC-supported PI groups were known to staff before the groups were begun, which indicates that EC support was perceived as particularly useful for PI groups targeting cross-departmental problems and related processes. That is, apparently the availability of the EC system was seen as an "opportunity" for staff to carry out PI groups involving different departments, which were obviously necessary given the problems reported.

The assumption above was strongly supported by responses in structured interviews. When asked whether EC support made it easier or harder for PI groups to have members from different departments, structured interview respondents' answers were distributed as shown Table 2.

<table>
<thead>
<tr>
<th>Answer</th>
<th>Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made it easier</td>
<td>16</td>
<td>88</td>
</tr>
<tr>
<td>Had no effect</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Do not know</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2: Distribution of answers from 18 respondents
(Question: Did EC support make it easier or harder to have members of different departments cooperating in your PI group?)

When asked to explain their answers, two main explanations were given by the respondents who were of the opinion that EC support made it easier to have members of different departments in PI groups. Those explanations were:

(1) That EC support enables group discussions to be carried out without affecting individual timetables (8 respondents).

(2) That EC support reduces the influence of distance (5 respondents).

The first explanation emphasises the perceived reduction in the disruption of member's functional activities (i.e. routine activities) due to PI group meetings. It is likely that this perception was influenced by two underlying perceptions, aired by group members in
unstructured interviews: (a) That had the PI groups been carried out only through face-to-face meetings, group members would probably have to attend to three or more separate face-to-face meetings per group, owing to the different group stages of the PI group discussion (i.e. process definition, analysis and redesign) requiring different types of knowledge and information to be carried out; and (b) That each of these face-to-face meetings would probably be relatively long - i.e. from 1 to 10 hours. These perceptions are supported by our previous experience facilitating face-to-face improvement groups in a similar action research study (Kock and McQueen, 1995).

The second explanation given by respondents suggests a perceived relationship between departmental heterogeneity and site heterogeneity, since the question asked concerned only departmental, not site, heterogeneity. This perception is supported by the moderately strong correlation (Pearson r = 0.70, P<0.05, 1-tailed), shown in Table 3, between the variables number of departments and number of sites in PI groups, which suggests that, as the number of departments involved in a PI groups grows, so does the number of sites involved.

<table>
<thead>
<tr>
<th></th>
<th>Duration</th>
<th>Departments</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>-0.22</td>
<td>0.89*</td>
<td>0.84**</td>
</tr>
<tr>
<td>Duration</td>
<td>0.22</td>
<td>-0.45</td>
<td></td>
</tr>
<tr>
<td>Departments</td>
<td></td>
<td></td>
<td>0.70***</td>
</tr>
</tbody>
</table>

Table 3: Coefficients of correlation (Pearson)
(*P<0.01, 2-tailed; **P<0.05, 2-tailed; ***P<0.05, 1-tailed)

The findings above indicate that EC support reduces the influence of two types of obstacles to departmental heterogeneity in PI groups: (a) The distance between group members from different departments; and (b) The disruption that face-to-face meetings are likely to cause for individual group members, particularly when these members are from different departments.
EC support effects on interdepartmental conflict barriers

Other than eliminating physical obstacles and reducing disruption, another type of impact EC support may have on interdepartmental communication is suggested from the analysis of two of the PI groups. Prospective members of these groups strongly indicated that the EC support makes it easier to have members from different departments in PI groups because EC support decreases the influence of previous interdepartmental conflict on staff's decision to participate in PI groups. One of the prospective members of a group involving two conflicting departments, for example, stated that it would be easier to initiate the group discussion via the EC medium because:

...[EC] is not as formal as a face-to-face meeting is...there have been some arguments between [staff from the two departments] in the past...I don't think they would agree to face each other in a meeting room right now.

The "formality" of face-to-face meetings was, according to this prospective member, sharpened by the history of conflict between the two departments involved in the execution of the process(es) likely to be tackled by the PI group. Moreover, a face-to-face meeting can be interpreted by some staff as a confrontation exercise, which can lead to evasive behaviour. This comment from another group member, referring to the advantages of EC support in discussions involving conflicting departments, illustrates the increased individual safety fostered by EC support:

You don't have to face [the staff from the other department]...it is easier to discuss unpleasant things...when you don't have to face the people you're talking to.

This perception may be explained by the EC medium being perceived as less personally threatening by prospective members, particularly because they could always "lurk" without necessarily having to actively contribute to the group discussion. Our experience
suggests that this perception is accurate, as it seems exceedingly difficult for group leaders, for example, to control (i.e. increase or reduce) member participation, and thus to have a member to contribute to the group when he or she decided otherwise. For example, in one case a member was repeatedly asked over the phone and through short face-to-face chats by the leader of her PI group to contribute to the PI group discussion. She replied to these requests by saying that she would contribute "as soon as she had some time", but posted no message to the group discussion in which she was participating as a member. Later, in an unstructured interview, that member admitted having decided from the outset not to contribute to the group discussion, and that her agreement to contribute was just an evasive tactic. In face-to-face meetings, on the contrary, that member could have been "forced" to contribute simply by being asked direct questions by the group leader or any other group member.

Departmental conflicts often result of a situation where collaboration gives place to competition, where departments tend to blame each other for the lack of success in the achievement of self-set goals that disregard other department's constraints and limitations (Goldratt and Cox, 1986). This counter-productive climate can be improved through EC-supported PI groups, for a successful PI group will solve problems by means of process redesign proposals, whose implementation will typically involve a collaborative work of the members of the PI group. Moreover, process redesign proposals are reached through group consensus, a process that itself requires collaboration. The building of a more collaborative work environment fostered by EC-supported PI groups is illustrated by this comment from the leader of a PI group that involved two conflicting departments, made in an unstructured interview after the group was concluded:

[one of the members of the other department] had been avoiding greeting or talking to me...probably because of my complaints about lab problems...after this [PI] group, though, our relationship improved considerably...we work more as a team now than before.
On the other hand, another group member was of the opinion that EC support can cause interdepartmental conflicts to escalate, as group members are more likely to be more sincere in their criticisms, often to the point of being downright blunt, when interacting through the EC medium - a phenomenon generally called “flaming” and attributed to the lack of social moderation in computer-mediated communication in general (Sproul and Kiesler, 1986; 1991). That member made the following comments about his electronic postings addressed to another member. The other member held a more senior position than him in the organisation, and had recently aired critical comments about his performance in front of some of his colleagues.

...I told him I didn't like it, straight off...Sometimes [the other member's contributions] get more rough and abrupt and of course I can't reply to him face-to-face. He can put me down...I don't want to face him and he would probably want to face me to [put] me down.

The perceptions outlined in this section indicate that EC support is likely to reduce interdepartmental conflict obstacles to the formation of PI groups. Whether this is inherently positive, though, is another matter. For example, if EC support fosters communication between conflicting departments, but that communication leads the conflict to escalate, EC support may be doing more harm than good. Some of the anecdotal evidence presented here partially supports previous research findings that indicate that computer mediation increases group conflict (Kiesler et al., 1984; Easterbrook et al., 1993). However, some of the individual experiences reported in this section indicate that interdepartmental conflicts can be solved, and the relationship between departments considerably improved, through EC-supported PI groups. This seemingly contradictory results can be explained by differences in the way individuals handle conflict, which can, in our view, be shaped by social and financial rewards, changes
in the management paradigm, and staff education on how to effectively use EC to support PI group interaction.

**EC support effects on individual learning**

Process teams often encompass staff housed in different departments. This occurs because, as discussed previously in this paper, staff are typically grouped according to their expertise, rather than their involvement in the execution of specific processes (Hammer and Champy, 1993). In this context, knowledge communication is an essential part of team learning. Without knowledge communication it is impossible to build shared meaning within teams, and is therefore difficult to build team alignment - that is, it is difficult to enhance the teams' capability of thinking and acting with a sense of unity. Team alignment requires team members to "know each other's hearts and minds" (Senge et al., 1994, pp. 352), that is, to share individual knowledge (e.g. beliefs and mental models) relevant to the effective accomplishment of their interrelated functional activities.

The empirical literature on asynchronous groupware technologies reports a number of failures of these technologies to effectively support knowledge communication between interdepartmental groups, particularly because of the equivocality that the electronic medium adds to the communication (Rogers, 1992), social norms and reward systems adopted by organisations that can themselves be obstacles to knowledge sharing (Orlikowski, 1992), and the disparity of benefits between those who have to do extra work because of the introduction of the groupware system and those who do not (Grudin, 1994). Moderately positive results have been found concerning the support that asynchronous groupware technologies can provide to the building of organisational knowledge repositories (Ackerman, 1994; Kock and McQueen, 1995).

Given the results summarised above, which suggest grim expectations regarding EC support to interdepartmental knowledge communication in the context of PI groups,
interview respondent's perceptions in our study have been overall surprisingly positive. When asked whether EC support increased or decreased individual socio-technical learning in PI groups, i.e. learning about processes and social norms in the organisation, structured interview respondents' answers were distributed as shown in Table 4.

When asked to explain their answer, two main explanations were given by the respondents who were of the opinion that EC support increases socio-technical learning in PI groups. Those explanations were:

(1) That EC support makes group members interact in a more sincere way, letting other group members know what their opinions are about other staff, process design, and process performance (5 respondents).

(2) That EC support encourages members to write better thought out contributions because of the higher perceived equivocality inherent in the communication medium used (5 respondents).

<table>
<thead>
<tr>
<th>Answer</th>
<th>Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
<td>12</td>
<td>67</td>
</tr>
<tr>
<td>Reduced</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Had no effect</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Do not know</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 4**: Distribution of answers from 18 respondents (Question: Did EC support increase or reduce your individual learning from participating in your PI group?)

The main explanation for the perceived reduction in socio-technical learning, given by respondents, was the lack of immediate feedback fostered by the almost exclusive use in most groups of EC as their communication medium. This lack of immediate feedback was perceived as increasing equivocality, especially in the process analysis stage of PI groups where a relatively large amount of process-related knowledge and information have to be
assimilated by the group members. The following comment from a senior manager regarding his PI group illustrates this point:

*I think that groups dealing with complex issues will find [EC] a poor medium. For example, I could not understand what [a member of my group] meant by...nor the reply by [another member]...However, for [PI groups dealing with] simple problems, such as the lack of feedback on computer support job status, [EC] is great!*

Interestingly, when asked whether the EC medium would negatively affect group risk taking, that senior manager replied negatively - i.e. that group risk taking is not directly affected by EC support. He made it clear, however, that the exclusive used of the EC medium would certainly increase equivocality when complex issues were discussed, which could in consequence affect commitment towards process redesign proposals. This could indirectly reduce the confidence of groups to take risks. According to that senior manager, group members would not own the group outcome if they did not understand completely the issues discussed, and therefore group agreement on risky process redesign decisions (e.g. decisions that involve high capital investment) would be compromised.

The findings above suggest that EC support influences both positively and negatively individual learning in PI groups. However, the higher proportion of respondents who thought that EC support increases, rather than decreases, individual learning suggests that the positive effects of EC support may offset the negative effects.

The main reason for the decrease in individual learning, according to the respondents, was the higher equivocality caused by the EC medium, which can be reduced by group members improving the clarity of their electronic contributions. However, a higher quality of electronic contributions was one of the reasons why respondents thought EC support increases individual learning. The integration of these two main results suggests that message clarity is likely to moderate the impact of EC support on individual learning. Our
participant observation suggests that message clarity can be increased by group members following simple guidelines, such as defining unclear terms used in electronic messages in the body of those messages, avoiding ambiguous sentences, and explaining the rationale behind statements and decisions.

**Conclusion and implications**

Overall, EC support seems to have a positive impact on knowledge dissemination in organisations, when used in combination with a group methodology for PI. In this study the PI group methodology used was MetaProi (Kock, 1995), which comprises a set of activities (i.e. a process), guidelines, and a graphical tool to be used by PI groups. EC support effects on PI groups can be summarised as: (a) A reduction of the influence of distance and other physical obstacles to the participation of members from different departments in PI groups, and of the disruption that group discussions are likely to cause for individual group members, particularly when these members are from different departments; (b) A reduction of interdepartmental conflict obstacles to the formation of PI groups; and (c) An increase or decrease in individual learning in PI groups, depending on the complexity of the issues being discussed and the clarity of electronic contributions by members. EC support effects (a) and (b) provide partial support for a positive answer to research question (1) - Does EC support reduce the obstacles to departmental heterogeneity in PI groups? EC support effect (c) provides partial support for a positive, but somewhat contingent, answer to research question (2) - Does EC support increase individual process-related and social learning in PI groups?

One of the implications of (a) is that EC support is likely to increase the number of possible interdepartmental PI groups per unit of time in organisations. This rate can be further improved by another factor, other than the reduction of the influence of distance and physical obstacles to PI groups and of the disruption of member's functional activities - the fact that group members can participate in several groups at the same time. Indeed,
participant observation and unstructured interviews in this study revealed that staff can effectively participate as members in at least 3 PI groups at a time. This, in turn, is likely to increase the speed and breadth of knowledge dissemination, which are described by Redding and Catalanello (1994, pp. 27-28) as two of the three most relevant dimensions of organisational learning.

A direct implication of (b) is that EC support to PI groups can foster what Argyris (1977; 1992) christened double-loop learning, since the EC medium increases sincerity and can thus decrease the likelihood that members will "hide" errors and organisational problems. On the other hand, if staff are not educated on how to effectively use the EC medium for communication (e.g. on how to explore the psychological effects of the medium in a positive way), EC support may increase conflict to a point where it may either be rejected as an appropriate communication medium for PI groups, or, which is worse, undermine the confidence of staff on the PI group as an appropriate tool for organisational learning and competitiveness improvement.

Two implications stem from (c). First, that EC support to knowledge dissemination can be more effective if either staff are educated on how to reduce equivocality when interacting via the EC medium, or new EC systems that incorporate visual and sound aids for communication are used. Given that EC-mediated interaction today is mostly written, and thus very seldom relies on the use of non-verbal cues, much of the theory and techniques on written business communication can be of immediate use to reduce the equivocality of EC-mediated communication in PI groups. Second, that whenever complexity is perceived to be high in a PI group (complexity symptoms are, for example, a high degree of perceived abstraction in the problems being discussed and a high number of misunderstandings in the initial stage of the group discussion), the success of that group in disseminating knowledge will depend on the group's ability to combine face-to-face meetings with EC-supported discussion. In groups using MetaProi or a similar group
methodology, our study findings suggest that at least one stage - the analysis stage - could benefit from the use of face-to-face meetings when complexity is perceived to be high.

Acknowledgments

We would like to thank the staff at School and MQM who have participated in the process redesign groups described in this paper. Special thanks are also due to Peter Grace, who reviewed and provided valuable comments to the manual that describes the methodology used by the groups MetaPoi.

References


