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**Developing new group work practices:
An evaluation of the design and use of groupware-based work systems for a
graduate student course in Information Systems**

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Executive summary

New technologies offer opportunities to support group work in organisations. We have modelled this through our teaching in Information Systems courses. This paper presents a description of the design, use and exploratory evaluation of groupware systems to support group project work.

In our courses, students are first introduced to a variety of ways of "doing work" and are then encouraged to design their own ways of working, mixing electronic workspaces with face-to-face and other means of communication, from both on and off campus, to perform (usually assessable) tasks. Opportunities and constraints effect the way that groups evolve their work systems; the main opportunity that students have is that they can hold face-to-face meetings when they attend lectures or tutorials on campus; the main constraint is that some (still the majority of) students do not have dial-up access to electronic workspaces off campus.

Our evaluations show that the majority of students prefer to work face-to-face but a significant minority prefer to use alternate technologies including groupware, particularly when personal and work commitments make face-to-face meetings inconvenient. Our aim is to facilitate the use of groupware while not forcing all students to use the technology. We found that this is practicable for students who are interested to learn new technologies and then choose if and when to use them further. We also found that to enable the continued voluntary use of groupware, and development of new work patterns, by students, several issues need to be addressed:

- because it takes the at least one semester for students to start to develop new work practices incorporating group technologies, the introduction of groupware should ideally start at the beginning of a student's course
- there needs to be a critical mass of students who know how to use the technology and hence can make choices about if and when to use it
- there needs to be a mechanism to assist in group formation (e.g. information about potential group members, contact details, private electronic communication areas, public "café" areas for informal "getting to know you" discussions)
- students need to be able to create and manage, with confidence, their own electronic workspaces, including as much or as little workspace structure as they choose
- there needs to be easy access from both on and off campus (i.e. home or work access to electronic workspaces)
- there needs to be an environment where new approaches are encouraged by students and staff, including good training and support.

Developing new group work practices: an evaluation of the design and use of groupware-based work systems for a graduate student course in Information Systems

Introduction

Background

New technologies offer opportunities to support both individual and group work in organisations. We have modelled this through our teaching in Information Systems (IS) courses. For individual work, electronic access to course materials and staff is easily provided, and is not complicated by any need for students to coordinate activities with peers. However, group work is a more complex and potentially rewarding issue. Group work has always been a major focus of our Information Systems courses, where systems design methodologies emphasise the importance of group processes (Martin and Collings, 1996). However, students find that group work, though an important skill, can be inconvenient and, where travel is concerned, expensive. Part time students in particular find that agreeing on suitable times and places to meet can be difficult (Collings, Edmondson and Webb, 1995).

The increasing ownership of computers by students gives them access to dial-up resources on campus, from home and work. This has created a demand for electronic resource access from our students (Mudaliar, 1994) and has encouraged us to support "mixed mode" activities to facilitate group project work. "Mixed mode" or flexible activity means that students work on group projects in a combination of face-to-face and electronic workspaces in a manner evolved by themselves but assisted by systems designed by staff for this purpose. This flexible way of working has been proposed or is being developed by many educational institutions in ways appropriate to their particular environments (for example see: Harasim et al, 1995; Hiltz, 1995; Mason, 1996; Taylor, 1995; Messing and Cornish, 1996; Stacey and Thompson, 1996). In our case, a distinctive rationale for our work is the need to model employer business environments. This means we focus on courses where group work skills are seen as essential by employers and are integral to the way projects are undertaken.

Overview of design, development and evaluation work

We have designed electronic workspaces to support the development and performance of flexible work groups in Information Systems units. We have designed electronic spaces for informal discussions (an electronic café), group product development, work product sharing (an electronic repository), private conversations, communication with staff, electronic submission of assessable work (and return) and electronic access to lecture, reference and other unit materials. These electronic spaces are used to introduce students to new workspace types, to support individual activities and for assessable collaborative work projects. The spaces have been designed for an asynchronous groupware platform and provide a consistent user interface. Students can influence the evolution of these workspaces by defining new groups.

Our evaluations show learning to work in this flexible mode, that is to move between face-to-face and electronic workspaces, is challenging, especially in defining new "rules of engagement" and "rules of conversation". Issues of who will or won't respond to or even notice electronic work requests are an example of this. There is a considerable learning effort for students especially where electronic *group* work is involved. We have found that mixed mode, flexible work involves both opportunities and constraints; we have identified and attempted to work within two of these in particular. The *opportunity* is that, as students attend campus for lecture and tutorial sessions, they can perform some of their group interaction face-to-face and take advantage of on-campus time for particular (often complex and dynamic) activities. The *constraint* is the uneven access to off-campus technology. Some have dial-up access from off-campus, others do not. Those without dial-up access can contribute only slowly (i.e. infrequently) to electronic spaces, those with dial-up access may have contention problems, in the form of competition for scarce resources (phone lines). Opportunities and constraints effect the way that groups evolve their work systems.

Theoretical framework

The theoretical framework for this project contains ideas from several areas: computer supported cooperative work, in particular organisational implementation issues (for example as expressed by Orlikowski, 1992, and Cockburn and Jones, 1994), computer supported collaborative learning (in

particular that based on constructivism, see O'Malley, 1992), and socio-technical systems design (for example, see Mumford and Weir, 1979). Our approach aims to combine ideas from these areas and provide student groups with flexibility in the way they learn. Students are first introduced to a variety of ways to 'do work', and are then encouraged to design their own ways of working (i.e. they design their own socio-technical systems), incorporating selected or self-designed electronic workspaces. This particularly matches the ideas of Keller when he discusses self-organisation of social systems and issues of how groups will evolve their own socio-technical work systems (Keller, 1996).

Groupware systems design

Developing the User's Mental Model

A user's mental model of a groupware system develops over time (Harasim, 1995). An important issue is how to facilitate this. Should this model be on the screen in the form of structure of some kind or should the user be given a model on paper with minimal structure on the screen? The latter provides flexibility. On-screen task structure may limit flexibility in the way groups decide to work but it may enhance productivity (McGrath and Hollingshead, 1994). We decided to provide some structure on the screen and to reinforce this through well-designed training including workbooks. Students could later choose how much structure they wanted. This approach is encompassed in the work of Mandviwalla discussing the importance of purposive behaviour of actors in the evolution of groupware systems (Mandviwalla, 1996).

Materials

Screen-based templates for specific work activities were designed to support group project work. It was anticipated that students would use the *group work* template to manage projects, develop and review work products and the *repository* template to store work products for reference (Collings and Walker, 1995; Millar, 1996) and that the combined workspaces would provide an informal short-term group memory (Ackerman, 1996). The templates were:

- a *group work* template supporting discussions, the development and review of products, and simple project management (work allocation)
- a *discussion* template to facilitate group development and informal conversations
- a *mail* template to support private conversations between peers and individual learning by private conversations between students and staff
- a *repository* template to support information management.

Work books were also designed including conceptual models of groupware and group work and exercises to help students develop new socio-technical models of work practice.

Implementation

Staff facilitated the use of the system, especially in the training phase. This facilitation involved checking that participation was occurring, answering private electronic queries, accepting and giving feedback electronically, and "seeding" electronic discussion and collaboration areas so that "someone" appeared to be out there. These "interventions" helped define "rules of engagement" and conversation in virtual workspaces. These are important issues of implementation for IT support for flexible work patterns (Harasim, 1995). These "interventions" were also suggested for student initiators of new workspaces in the training work books (especially in versions developed in the light of evaluations).

Facilitating System Evolution

Support was provided for students to install the groupware system on their home computers and to create new group electronic workspaces. Lecture and other course material was provided in an electronic *repository* to encourage individual learning and use of the system. Our implementation provided some structure on the screen for *group work* but also relied on groups developing their own structure for *discussions*. The main discussion structure in the templates was a simple "topic" and "response". We believed that this material and the resulting experience of using the provided systems, as facilitated by staff, would be enough to enable student definition of their work system.

Scenario for group work

In the unit Systems Analysis G2, students play roles in a large-scale behavioural simulation (Walker et al, 1996). The simulation is of an imaginary public authority, the Cultural Heritage Authority (CHA). Groups of 30 - 40 students participate in the simulation over a 12 week period. Participants hold face-to-face meetings for a two hour session (formal class time) weekly. The formal sessions are held in a Simulation Suite consisting of meeting rooms which contain a set of 4 networked PCs supporting a groupware infrastructure. The rest of the time, participants belong to the organisation and use electronic workspaces, accessible from their home, workplace or university laboratories to support the work they are doing (designing information systems, strategic plans, quality processes, etc. for the organisation). Although at first glance this may appear to be an unusual model of an organisation, it closely resembles a dispersed organisation in which members meet in "serviced offices" occasionally.

Evaluation

A detailed study was performed with the 64 students (working in two instantiations of the Cultural Heritage Authority) in the unit Systems Analysis G2, to evaluate:

- how groups communicated and how they performed work
- the perceived utility of electronic workspaces.

The study consisted of two surveys (which measured how participants communicated and their perceptions of the utility of the system), class discussions to follow up on issues identified, and an analysis of work group creation and use of electronic workspaces. The results of the study are summarised here. A more detailed analysis of the perceived utility of the system is presented elsewhere (Collings and Walker, 1996).

Results: survey 1.

The first survey required completion of a diary over weeks 4-15 of the semester. Students recorded, for an agreed set of activities, the communication methods used both in and out of formal sessions in the Simulation Suite. Table 1 shows the results of analysis of 525 satisfactorily completed diary pages. As can be seen, the most commonly used communication technologies were face-to-face meetings and electronic workspaces with supplementary use of phone and "other" (e.g. fax).

Activity	Face-to-face		Phone		EWS		Other	
	ISS	OSS	ISS	OSS	ISS	OSS	ISS	OSS
Information Gathering	58	32	8	14	24	39	10	15
Discussion	69	42	9	21	21	36	2	2
Development of Deliverables	61	37	6	8	24	39	9	16
Review of Deliverables	61	33	6	8	29	46	4	12
Management/Administration	71	34	6	18	17	42	6	5
Social Activity	80	43	3	9	16	43	1	4
Other	68	31	1	7	15	32	17	29

Table 1. Communication preferences (EWS=Electronic Workspaces) for activity performance in (ISS) and out (OSS) of Simulation Sessions as a % of the Diary Pages on which the activity appeared (Sample: 525 pages).

Discussion

The results, supplemented by individual and class discussions, establish the fact that students value face-to-face communication. They are also interested to explore and use electronic workspaces to assist group project work. A broad set of communications technologies is used to achieve outcomes and students design their own ways of doing group work. This seems to us to be a group's evolving form of "multimedia conversation" which incorporates electronic workspaces into a way of developing work products (de Michelis and Grasso, 1994).

Results: analysis of workspace creation and use

A total of 434 documents in 10 public, group electronic workspaces (i.e. excluding private mail boxes) showing substantial use by 64 participants over a 9 week period was analysed by counting and categorising the documents as shown in Table 2. The four functions of group workspaces were found to be:

- Post a document for comment.
- Comment on a document.
- Broadcast a message which is either an item posted for information, or a general request or query.
- Post a personal message, which is a message addressed to a particular person but publicly accessible.

Document Function	% Occurrence
Document	17%
Comment	5%
Broadcast Message	31%
Personal Message	47%
Total	100%

Table 2. Document Occurrence by Function
Public, group workspaces having substantial use,
Sample size = 434 documents.

Further analysis of the workspace types confirmed the results indicated in Table 2 that the workspaces were not used in the manner anticipated by staff. The workspaces with most activity used a *discussion* template. The workspaces with more structure, such as that designed for product development and review based on the *group work* template, were used very little.

Discussion

The analysis of the workspaces, supplemented by class discussion, indicated that students did not complete projects in electronic workspaces and did not use the structured spaces provided for this purpose. Rather, they posted documents to the electronic workspaces in advance of face-to-face meetings and this enabled better preparation for those meetings, the obtaining of preliminary feedback, and (on occasion) the reporting of outcomes. The substantial discussion and decision-making was not done electronically. There were only 1/3 as many comments as there were documents posted. Because participants knew that some others (especially part time students without off-campus access to electronic workspaces) accessed the electronic workspaces only a few times a week, they used the space as a bulletin board and used other means (face-to-face, phone and fax) when *rapid* interchange of ideas between two or several people was required.

Results: survey 2

A second survey was designed and administered to 64 students to assess the utility of the electronic workspaces; 41 were completed and analysed. Key items from the survey are shown in Table 3 as average values for each group with 7 = strongly agree, 1 = strongly disagree.

F/T = full time; P/T = part time; DA = dial-up access to electronic workspaces.	F/T, DA (N=6)	F/T, no DA (N=14)	P/T, DA (N=8)	P/T, no DA (N=13)	Av. (N=41)
Participants experience greater satisfaction in contributing to group work because they can do so at a time and place which is convenient.	5.5	3.6	4.6	3.5	4.0
Participants can use their time more effectively.	5.7	4.6	4.3	3.5	4.4
The quality of the end product is better because all members of the group have the opportunity to contribute.	5.0	3.9	3.5	3.5	3.9
The quality of the end product is better because design decisions are properly documented.	4.5	3.9	3.4	3.9	3.9
More options are canvassed among group members if groupware is available and used.	4.8	4.0	4.3	3.6	4.0

Table 3. Evaluation of the value of electronic workspaces as a supplement to face-to-face meetings in a student context, N=41, scale 7=strongly agree, 1=strongly disagree.

Discussion

Overall the students felt that the use of electronic workspaces was effective. Their work design was effective in that, in their opinion (and the opinion of staff, but that is not measured here), a better product resulted. Students had some basis for making this judgement in that they had previous group work experience at the University. They also found the process effective in that more options were canvassed and participants were more satisfied with projects using groupware than with previous projects for which this technology was not available. Part time students with no dial-up access found that the overhead of learning and using the technology could be overly time consuming and not cost effective. Full time students with dial-up access had the most positive view of the value of electronic workspaces as a supplement to face-to-face meetings.

Results: class discussions

Throughout the evaluation process, especially in class discussions, it became clear that students felt that time was an issue, both for learning and integrating the technology into the way they worked in project teams. Training materials did not include enough worked examples. Students also reported not having enough control over their creation of electronic workspaces or enough training materials to support this. Further, there were not enough PCs in the Simulation Suite to assist in integrating face-to-face and electronic workspaces. They reported that the workspace for development of deliverables that we had designed (using the *group work* template) did not match the needs of their work groups. More significantly, they reported a need for more time to evolve new work patterns. We also observed this, informally, among staff colleagues involved in the project who were also utilising this technology. Participants also reported that they developed work practices typically using face-to-face meetings to resolve complex issues, and electronic spaces for less complex and less fast moving interactions, matching the generally low frequency of access to electronic workspaces for some students.

Overall discussion

These outcomes are consistent with studies of the affordances of media spaces (Gaver, 1992) in that, as far as the use of structured electronic workspaces is concerned, students do not like much structure except for highly specific short term tasks. Structure seems to make the space too specialised. However, once a structure which helps deliver outcomes has been used, it is often practiced informally in preference to its formal presence. Participants like to evolve their own rules of conversation, albeit based on experience with a variety of structures. It is a matter of learning new rules of behaviour by example. It appears to us that it takes a long time for groups to establish their own rules of behaviour in

electronic spaces, combined with real, face-to-face spaces. For example, students can be quite annoyed when their electronic work has not drawn the "expected" response. The solution generally adopted for this type of "problem" is to create a "face-to-face" event to elicit feedback from their peers. Students negotiate expectations and develop them over a considerable period as the need arises. One semester in a part time student environment is not enough, it seems, for large groups to establish workable relationships.

Current directions

Based on our evaluations, we have moved the teaching and use of asynchronous groupware to a 2-unit sequence, using the first unit to prepare students for their work in the simulated organisation. We have extended the training work books to provide graded exercises, undertaken in the student's own time (and hence asynchronously), to develop skills, a conceptual model of flexible, mixed mode work, and to provide information on the creation and maintenance of new electronic work groups and workspaces, and how to facilitate their use. We have designed two new structured electronic workspaces as starting points for students to learn how to use groupware. The spaces are an electronic *journal* and an electronic *meeting*.

New directions?

Preliminary indications are that these steps have made the learning and use of the technology easier, allowing students to concentrate on the task rather than the technology. Students are now *choosing* if and when to use electronic workspaces for project work. In some cases they view electronic work spaces as the *only* way that group work can be effectively done by members of distributed groups. They are being innovative in their design of new group work systems. Our electronic workspaces are evolving to support groups in the development of their own flexible work systems.

Conclusion

This paper reports on our aim to facilitate the use of groupware and the development of new work practices for students while not forcing the use of new technologies. We found that this is practicable for students who are interested to learn new technologies and then choose if and when to use them further. We also found that opportunities and constraints effect the way that groups evolve their work systems; the main opportunity that students have is that they can hold face-to-face meetings when they attend lectures or tutorials on campus; the main constraint is that some (still the majority of) students do not have dial-up access to electronic workspaces off campus. We also found several issues which need to be addressed:

- because it takes the at least one semester for students to start to develop new work practices incorporating group technologies, the introduction of groupware should ideally start at the beginning of a student's course
- there needs to be a critical mass of students who know how to use the technology and hence can make choices about if and when to use it
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- there needs to be easy access from both on and off campus (i.e. home or work access to electronic workspaces)
- there needs to be an environment where new approaches are encouraged by students and staff, including good training and support.

Developing new modes of work, new types of socio-technical systems, takes time and energy and studies such as ours help inform students and systems developers about issues in the design and management of change related to new, flexible work methods utilising information technology.

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