International Collaborative Learning--The Facilitation Process

International collaborative learning is becoming more viable through a variety of Internet enabled software products. Group Support Systems appear to offer promise. But it is not well understood how to facilitate the teaching and learning process in electronic environments. If education is to involve an interactive process of collaborative inquiry and dialogue between remote groups of learners, then designing meaningful learning experiences presents challenges in logistics, technology support, software design, and pedagogy. To better model the facilitation process in such environments, a theoretical framework based on an extension of Adaptive Structuration Theory is suggested. This framework is then related to experiences with custom application software development using Lotus Notes Domino(TM), internal trials and a limited scale collaborative learning exercise between students at Auckland Institute of Technology and Uppsala University. The paper concludes by providing some recommendations for the redesign of the application, suggesting revisions to the collaborative process based on the framework presented, and discussing further extensions to the trials. (Contains 21 references.) (Author/AEF)
International Collaborative Learning – The Facilitation Process

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Abstract: International collaborative learning is becoming more viable through a variety of Internet enabled software products. Group Support Systems appear to offer promise. But how to facilitate the teaching and learning process in electronic environments is not well understood. If education is to involve an interactive process of collaborative inquiry and dialogue between remote groups of learners, then how to design meaningful learning experiences presents challenges in logistics, technology support, software design, and pedagogy. To better model the facilitation process in such environments, a theoretical framework based upon an extension of Adaptive Structuration Theory is suggested. This framework is then related to experiences with custom application software development using Lotus Notes Domino™, internal trials and a limited scale collaborative learning exercise between students at Auckland Institute of Technology and Uppsala University. The paper concludes with some recommendations for redesign of the application, suggests revisions to the collaborative process based upon the framework above and discusses further extensions to the trials.

Introduction

Numerous teaching and learning initiatives, frequently cited in conferences such as this, now include an Internet dimension. Different products such as the common “chat”, “email”, and “newsgroups”, are being used to support collaborative learning (Siviter, Petre & Klein, 1997). In the business environment, organisations seeking to link disparate global teams are increasingly using groupware products such as Lotus Notes® (Lloyd & Whitehead 1996), and this form of product appears to have much to offer to support collaborative learning processes (Galpin & Birchall 1996). In this paper when talking of collaborative learning, the term is being used in the sense suggested by Siviter, Petre & Klein, 1997. They place it in the context of “groupwork”, broken down into three interrelated components of “communication, collaboration and coordination”. These activities in turn may be supported by groupware – a term “adopted to describe systems that support groupwork” (Siviter, Petre & Klein, 1997). “Groupware technologies provide electronic networks that support communication, collaboration and coordination through facilities such as information exchange, shared repositories, discussion forums and messaging. Such technologies are typically designed with an open architecture that is adaptable by end users allowing them to customize existing features and create new applications”. (Orlikowski & Hofman, 1997) The Lotus Notes Domino™ application discussed in this paper can be categorised as an example of an open ended customizable groupware product, and of different time, different place groupware.

Group Support Systems (GSS) is an alternative term for groupware. Previously termed Group Decision Support Systems (GDSS), which covered particularly that class of systems known as electronic meeting systems, the GDSS research generated the Adaptive Structuration Theory model (DeSanctis & Poole, 1994) discussed in this paper. Group Support Systems has been suggested as a generic term for the field (Nunamaker et al., 1989), and defined by Whitworth (1997) as:

"GSS: any system which supports a group interaction by becoming an integral part of that interaction"

In this paper the terms GSS and groupware will be used somewhat interchangeably.

Facilitation and Group Support Systems

The Group Support Systems (GSS) field has tuned its focus from more technocentric aspects, to broader study of how effective the technology is in use. Dennis and Gallupe (1993) have identified five stages of GSS research, which evidence this trend. Stage four covered field studies of the organisational impact of GSS, and stage five an in depth focus on specific aspects - one of which is the role of the facilitator. A further stage seems to be evolving, which focuses on organizational issues associated with the mutual influence of technology and social processes. This stage represents an extension from stage four’s focus on the more deterministic organizational impact of GDSS. A research approach based upon the study of these interaction effects seems particularly suited to investigating the role of the facilitator in conjunction with GSS.

It is apparent for instance, that the complexities of GSS use in the Electronic Meeting Support context, cannot sensibly be understood without inquiry into the interaction effects between dimensions of the group and the group process, the skills of the facilitator and the technology. Likewise in asynchronous groupware contexts an analysis of interaction effects may prove a productive approach to understanding the complexities of groupwork in these distributed electronic environments. It has been suggested that “organizations need the experience of using groupware technologies in particular ways and in particular contexts to better understand how they may be most useful in practice”. (Orlikowski & Hofman, 1997)

This paper discusses a general framework for analysing technology facilitation roles. It is shown how this model might be applied to the facilitator role and provide a basis for an “interactionist” model for GSS’s, which may be extended to improve our understanding of the processes involved in electronic collaborative learning.

Structuring Processes and Information Technology
Orikkowski and several colleagues have been following an interactionist line of research into Information Technology for some time. Their model of technology is structurationist in approach, based upon the work of Giddens (1984) and the concept of technology as an “occasion for structuring” (Barley, 1986). Initial work identified the reflexive nature of Information Technology (IT) in which IT both shapes and is shaped by the actions of users and the organisational context (Orikkowski, 1992). Subsequently the concepts of metastructuring and technology-use mediation (Orikkowski et al., 1995) are introduced as further sources of structuring. These two key terms of the Orikkowski model are defined as:

1) **Metastructuring** While “The research on technology structuring tends to focus primarily on the activities of users who shape their technology as they use it in particular contexts”, [there are] “another set of activities that, although carried out by users, are not activities of use. Rather they involve the shaping of other users activities of use, a process we designate as metastructuring...The notion of metastructuring allows us to see that interventions in users’ use of technology occur frequently over time, in a variety of ways, and are often very influential” (Orikkowski et al., 1995)

2) **Technology-use mediation** Orikkowski et al. refer to “a particular type of metastructuring, technology-use mediation, and find that it structures users’ use of technology by influencing their interpretations and interactions, by changing the institutional context of use and by modifying the technology itself. Because technology-use mediation is a sanctioned, explicit, deliberate and ongoing set of activities, we argue that it is a particularly powerful mechanism in the context of dynamic organisations, enabling rapid and customised adaptations of the technology and its use to changes in circumstances, organisational form and work practices” (Orikkowski et al., 1995)

In their study of the use of a computer conferencing system in a Japanese R&D project group (Orikkowski et al., 1995), identified four different types of mediating activities that the network administration group members performed. These were: establishment: established role, determined and built consensus around use of the communication technology, established guidelines etc. for its use; reinforcement: training, monitoring, and follow-up with members and the group to reinforce the established guidelines; adjustment: on the basis of feedback obtained from members, adjusted the definitions and usage rules for specific newsgroups and occasionally added new newsgroups on request; episodic change: twice during the project, NAGA initiated major changes to the news system as a whole.

**Structuring and Facilitation Processes**

“Facilitation is a dynamic process that involves managing relationships between people, tasks and technology, as well as structuring tasks and contributing to the effective accomplishment of the meeting’s outcome” (Bostrom et al. 1993). It is argued here that both metastructuring and technology-use mediation are closely allied to the concept of facilitation in GSS environments, whether in synchronous or asynchronous modes.

**The Structure of a “Meeting”**

Bostrom et al. (1993) define a meeting as “a goal- or outcome-directed interaction between two or more people (teams, groups) that can take place in any of four environments (same time/same place, same time/different place, different time/same place, different time / different place)...Most GSS facilitation research has focused on face-to-face environments (same time/same place)”. In this paper by contrast, the collaborative learning trials have been designed to operate as an extended meeting, in the different time, different place environment.

Bostrom et al. (1993) further note that “meetings rarely die, they just keep rolling along in a cycle of premeeting, meeting and postmeeting activities...The actual meeting is but one phase of a three-phase cycle of activities that constitute a meeting”. This fits with the shift from the earlier decisionist view of GDSS towards more of a concept of Group Support Systems, where the group decision-making processes are more ones of managing “issue streams” (Langley, Mintzberg et al., 1995), a model better suited to asynchronous than synchronous GSS. Elaborating upon Bostrom’s structure, Ackermann (1996) defines the concept of a “meeting” as broken into several stages:

- the pre-meeting stage;
- the meeting itself with three sub-stages
  - introductory,
  - exploration and development,
  - closure
- the post-meeting stage.

**Electronic Collaborative learning trial**

A collaborative electronic learning trial is now briefly described to enable a concrete exercise to be related to the concepts being developed in this paper. Some pilot trials had involved an intra-institution at Auckland Institute of Technology with an experimental generic collaborative database developed using Lotus Notes Domains (Clear, 1998). Subsequently a cross institution collaborative trial had been arranged. This trial involved a Computer Science class at Uppsala University, collaborating with a class of Business students at Auckland Institute of Technology. The Uppsala group consisted of approximately 80 students and the New Zealand group approximately 20. Both groups were to collaborate on a common task involving a role play. The Auckland group were to be business analysts consulting to a local client, while the Uppsala group were a group of software game developers, with whom the Auckland consultants had to liaise. The purpose of the exercise was to jointly develop a feasibility study for a computer game to support the client’s need for a software product. The software product was to help young pharmacy assistants become more informed about the client’s nailcare product range. By better diagnosis of customers’ problems, greater sales of products and reduced instances of misdiagnosis and nail damage were expected to result. The project scenario thus represented an opportunity for problem based learning (Boud, 1985) based upon a live business case.

The trial took place over a 3-week period between September 22nd and October 22nd 1998. By the end of the exercise many of the students had made some progress in mastering the system, which had significant usability problems. The variety of different approaches and features used indicated a degree of ingenuity. Each combined group had come up with at least one design concept for a game, showing they had thought about the problem, variously using the database or e-mail alone to express it with.

In the definition of Bostrom et al (1993) above, this trial could be deemed a meeting.
Facilitation frameworks

Bostrom et al. (1993) propose a framework for understanding and investigating facilitation in GSS environments. “A given source of facilitation (external facilitator, leader, member, GSS) provides structures (e.g. agenda, procedures, GSS tools) and/or support (e.g. the facilitator administers a procedure, or deals with a disruptive participant) to a group in order to positively influence how the group accomplishes its outcomes. Structures provide an overall frame or context to activate individuals or groups to behave in a particular way. On the other hand, support activities are used primarily to maintain and promote these structures, encourage effective task and relational behaviors, and deal with disruptive influences in the meeting. A facilitator, by his or her actions, attempts to influence three general targets: meeting process, relationships, and task outcomes. This facilitation framework may support several different levels of analysis - the individual, subgroup or entire group.

Adaptive Structuration Theory (AST) has been suggested, as a theoretical perspective which “provides a general framework for investigations” of the facilitation process. “From an AST perspective, the role of facilitation is to select and present beneficial structures to groups in a manner that encourages their faithful appropriation. A key construct within AST is appropriation. Appropriation is the process by which participants invoke or enact available structures (e.g. GSS, agenda, etc.) and thereby give meaning to them...AST posits that the success of an appropriation is determined by three dimensions, the faithfulness (in respect to the structure’s design principles) of the appropriation, the group’s attitudes towards the structures, and the group’s level of consensus (i.e. agreement on how structures should be used). As we discussed earlier, a facilitator affects all three of these modes through support activities: faithfulness through promotion and maintenance of structure; attitudes through activities that develop positive affect; and consensus through monitoring the group’s reactions and making appropriate adjustments.” (Bostrom et al., 1993)

The AST model (DeSanctis & Poole, 1994) developed largely from a view of technology “as an occasion for structuring”(Barley, 1986), which reflects the interactions between the technology, the institutional features of the organization and the actions of individuals. The extensions to this brought through the concepts of metastructuring and the notion of technology-use mediation offer the opportunity to augment the AST model in a manner which should more directly and discretely support investigation of the facilitation process.

Before developing the AST model to accommodate these dimensions, some threads from this paper will be tied together. The facilitator role is clearly difficult to model in any simple manner, and the different frameworks contrasted so far, help to further confuse the picture. Which dimensions relate to one another, and how should they be depicted? The classic GSS design constructs of “process support”, “process structure”, “task support”, and “task structure” (Nunamaker et al., 1993), who define them as follows, provide a useful starting point:

- “Process Support” - refers to the communication infrastructure (media, channels, and devices, electronic or otherwise) that facilitates communication among members...such as an electronic communication channel or blackboard.
- “Process Structure” - refers to process techniques or rules that direct the pattern, timing or content of this communication...such as an agenda or process methodology such as nominal Group Technique.
- “Task Support” - refers to the information and computation infrastructure for task-related activities...such as external databases and pop-up calculators.
- “Task Structure” - refers to techniques, rules, or models for analyzing task related information to gain new insight...such as those within computer models or Decision Support Systems (DSS).” (Nunamaker et al., 1993)

Domains and Mechanisms for GSS Facilitation

The table below attempts to link some aspects of the structuring and facilitation processes earlier described, to assess the role of the facilitator in the context of the Uppsala – Auckland collaborative trial (Clear, 1999).

<table>
<thead>
<tr>
<th>Domain</th>
<th>Design Contingency</th>
<th>Facilitation Means</th>
<th>Facilitation Avenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Process Support</td>
<td>GSS</td>
<td>parallel communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scanner, Photoshop™, Word™</td>
<td>group memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excel™, text editors &amp; GSS</td>
<td>group and individual contributions identifiable (as opposed to the usual anonymity in GSS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>email</td>
<td>media effects (photos, diagrams files etc. as well as text)</td>
</tr>
<tr>
<td>Institutional and Technology</td>
<td>Process Structure</td>
<td>External/ internal electronic facilitation</td>
<td>Individual or mail group messages, combined with external/ internal facilitation and GSS use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External/ internal facilitator, telephone, fax, email and GSS (in part)</td>
<td>Registration database, database forms and views, fax (as a last resort)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GSS</td>
<td>Global process structuring e.g. establish collaboration, determine client, task &amp; groups and advise, agree collaboration window setting, remote trial coordinators, project/group leaders</td>
</tr>
<tr>
<td>Institutional and Technology</td>
<td>Task Structure</td>
<td>External/ internal facilitator and GSS in Combination</td>
<td>Internal process structuring e.g. project, task, document, section, discussion threads, file attachments, on-line help, questionnaires, communication &amp; use of naming standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>use of GSS features such as project, document, and discussion thread hierarchies, views, hyperlinks and file attach/detach features plus remote trial coordinators, &amp; project/group</td>
</tr>
</tbody>
</table>
Table 1 Domains and Mechanisms for GSS facilitation

While the table shows some meaningful information, it does not provide a clear framework for understanding the facilitator role. For instance, the domain of individual’s actions, while implicit in each of the rows, is omitted, as is the area of relationships and specific support activities.

Temporal Analysis of Mediating Activities and Relationships with GSS Facilitation

In this next analysis, a time dimension is included, and the four mediation activities of Orlikowski et al. (1995) are used to structure the comparison. Illustrative examples are again drawn from the collaborative trial. (Clear, 1999)

<table>
<thead>
<tr>
<th>Mediating Activity</th>
<th>Meeting Phase</th>
<th>Design Contingency</th>
<th>Facilitator Actions</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment</td>
<td>Pre-Meeting</td>
<td>Process Support</td>
<td>Set up physical parameters and features of the technology</td>
<td>Confirm resources (system capacity, technical support etc.)</td>
</tr>
<tr>
<td></td>
<td>Pre-Meeting &amp; Meeting - introductory</td>
<td>Process Structure (global)</td>
<td>Modify institutional properties of the organization to facilitate technology assimilation</td>
<td>Organise creation of collaboration database and registration database for participants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Establish collaboration parameters (scope, purpose, content, participating &amp; timing with partnering institution’s facilitator)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Confirm suitability of task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process Support</td>
<td>Help users adopt and use appropriate cognitive and behavioral routines to use the technology</td>
<td>Facilitate change in technology use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structure</td>
<td></td>
<td>If facilitator is a developer, may fine tune views, forms etc. to enhance usability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Facilitator may advise technical support staff of problems needing attention (e.g. “out of file space” errors etc.)</td>
</tr>
<tr>
<td>Adjustment</td>
<td>Meeting - exploration and development</td>
<td>Process Support</td>
<td>Adjust technical features of the technology to promote use</td>
<td>If facilitator is a developer, may fine tune views, forms etc. to enhance usability</td>
</tr>
<tr>
<td></td>
<td>Meeting - closure</td>
<td>Process Structure (internal)</td>
<td>Modify institutional properties of the organization to facilitate change in technology use</td>
<td>Facilitator may advise technical support staff of problems needing attention (e.g. “out of file space” errors etc.)</td>
</tr>
<tr>
<td></td>
<td>Post meeting</td>
<td>Task Support</td>
<td>Redefine cognitive and behavioral routines to facilitate change in users appropriation of the technology</td>
<td>Facilitator may decide to deviate from plan of action and use different features of the GSS to support the meeting activity (e.g. attached files vs. document section entries)</td>
</tr>
</tbody>
</table>

Table 2 Temporal Analysis of Mediating Activities and Relationships with GSS Facilitation
From table 2 it can be seen that technology-use mediation does add to our understanding of the facilitation process, and can be incorporated into existing perspectives on the field of GSS and group facilitation.

The Extended AST Model - Including GSS Facilitation

Returning to the AST model, the above frameworks have suggested the value of technology-use mediation, but are relatively static as a base for further analysis. Given the inherently dynamic nature of the facilitation process, a model capable of reflecting that is required. The base AST constructs have been built upon to incorporate the technology-use mediation dimension. This now gives us an Extended AST Model, which includes technology-use mediation as a further source and form of structure within the model. At this stage the concept is generic, and could include other mediation roles such as systems administrators or designers, but the term technology-use mediator should be read to mean facilitator for the purposes of this paper.

![Extended AST Model Diagram]

Figure 1 Summary of Major Constructs and Propositions of Extended AST Model [based upon figure 1 ex (DeSanctis & Poole, 1994)]

The modified constructs are highlighted in the redrawn model (bold italics). Basically the three constructs dealing with sources and forms of structure have been augmented:

- **Other Sources of Structure**
  - has had the technology-use mediator (facilitator) added, with the assumption that much of this intervention would occur during either the establishment or reinforcement modes of activity as shown in table 2 above

- **Emergent Sources of Structure**
  - has had the technology-use mediator (facilitator) added, with the assumption that much of this intervention would occur during the adjustment mode of activity from table 2

- **New Social Structure**
  - has had the technology-use mediator (facilitator) added, with the assumption that much of this intervention would occur during the episodic mode of activity from table 2

Conclusions

The complexities of developing new forms of collaborative electronic pedagogy defy simple analysis. The above model is an extension of a model developed to support research in the GSS field. It may be criticised for assuming that meetings result in decision outcomes. Nonetheless it allows for "meetings" to be broadly defined, and some aspects of the "outcomes" construct do apply to educational activities of this nature. Its strength lies in its ability to encompass the several dimensions at play in such learning environments.

For instance in the Auckland-Uppsala trial several issues required attention. The collaborative task needed reconsideration, its scope was too ambitious in the time available and the degree of group interactivity demanded was too low. The process of establishing and assigning groups needs greater structure, probably through extra workflow features of the GSS. The organising elements and views of the database need simplification, and structures for reinforcing naming standards need to be more inbuilt than open to group selection. If anything the degree of genericity needs to be reduced and the application designed to more specifically suit the educational group collaborative context. The question of appropriation is an interesting one, given that half the groups were not faithful to the spirit of the groupware application, by choosing to use the more individualistic technology option of email. The extended AST model enables such issues to be discretely analysed in depth, but within a framework which does not omit the complex interaction effects.

Initial uses of groupware for collaborative learning tend to occur at the intra-institution level (Siviter, Petre, Klein, 1997; Schrum 1997), but as inter-institutional collaborations grow, it becomes important that we find ways to increase their chances of success, and develop means to research the effectiveness of such learning practices. The author intends to continue a programme of international collaborative learning trials. This extended AST model may be one means of better designing such trials, while considering all the relevant dimensions. It may also prove a useful means to analyse the complex interactions of actors, institutional factors and technology in groupware supported collaborative learning contexts.

Acknowledgements
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