Relationship Building in Virtual Teams: An Academic Case Study

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Abstract

Information Technology (IT) provides the infrastructure for communication and collaboration tools for virtual teams, but Henttonen and Blomqvist (2005) suggest that it is the relational communication and factors of trust, commitment and communication that attention. This case study presents a team building strategy for such interaction. Off-campus students in an undergraduate course apply technological design concepts for social mechanisms in communication and collaboration to virtual teamwork. Students utilise the themes of *conversation, awareness* and *coordination* and document their reflection on their use over the team lifecycle. All functioning teams indicated that these social mechanisms helped to build team trust and commitment. Seventy-two percent of students indicated positive team experience, despite constraints of workload, time pressure, technology tools, distance and uncooperative team members. This study argues that use of guided and iterative reflections on social mechanisms support virtual team functioning and strengthen relationships.

Keywords: academic virtual teams, success factors in virtual teamwork, online pedagogy for teamwork, communication and collaboration.

Introduction

Virtual teams are "groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organisational tasks" (Powell, Piccoli & Blake, 2004, p.7), or as Grundy (2004) states working virtual means *working together apart*. Organisational change employing virtual working enables industries to be globally competitive, provide flexible workspace, and just in time responses (Howard 2004; Powell, Piccoli & Blake, 2004). Enabling students to draw from their own reflective experiences within virtual team environments supports their transition into this community.

The focus on the communication and collaboration for virtual interaction has been built on technological usage, with limited attention to importance of social relationships in teamwork (Henttonen & Blomqvist, 2005) Loughran (2004) notes that obstacles include cultural differences, lack of shared goals, communication problems and lack of trust. The key, therefore for successful virtual team working, Henttonen and Blomqvist suggest, is interaction that develops "*trust through actions and communicating individual roles and shared goals*" (Henttonen & Blomqvist, 2005, p.117).

The design of technology for social online interaction is an area of study in

the discipline area, Human Computer Interaction (HCI). To build experience in tools for communication and collaboration, the course design implements assessment structures using virtual team tasks. Students reflect on the social mechanisms of communication and collaboration to understand the design issues in these tools. The same reflective processes are used for developing strategies to successfully work in virtual teams.

This paper argues that the reflective activities within this course provide tools for ongoing team building that focus on relational communication. The reflective logs require students to consider the face-to-face constructs of communicative and collaborative work and apply them to a virtual environment. Aligned to the team life cycle of input, process and output, students are required to document their understandings of the three mechanisms (conversation, awareness and coordination) and to consider these mechanisms support team interaction Examination of student reflections indicates that the successful teams utilised the three mechanisms to improve the individual interactions in teamwork and affect the team goals. Seventy-two percent of the students indicated that the virtual team work was a positive experience, despite constraints of workload, time pressure, technology tools, distance and uncooperative team members. It is argued that the reflective process used in this activity builds social relationships creating a more success team working environment.

To present this case study, the first section introduces the reader to virtual team life cycle and identified success factors and the outlines the constructs addressed by the social mechanisms for communication and collaborative technology. From this, the research question is developed. The case study is then presented, with rich levels of documentation of student responses to the three social mechanisms as they support the virtual team interaction and the achievement of the team tasks. For this study, the focus accents the relationship aspects from the data. The final section presents evidence of successful team interaction relating the three social mechanisms to positive success and relationship building

Background

This section presents factors that build successful virtual team environments, and the constructs under consideration for the social mechanisms of communication and collaboration. The aim is to understand the issues in virtual team successful interaction and to offer a solution through use of reflective logs in virtual team work guided by these social mechanisms. It is from this foundation that the research question is designed.

Successful Virtual teams Environments

Powell et al. (2004, p.7) provide a meta-analysis of 44 papers on virtual teams, covering both academic and industry teams. Their analysis is framed on Saunders' (2000) life cycle model for virtual teams, divided into three stages. Figure 1 presents the life cycle in its three stages of Input, Process and Output. Each stage has subparts which address critical aspects of the cycle. For the Input stage, *design* refers to shared understanding of the team task, identification of strengths and weaknesses of team members; c*ulture* refers personal environmental influences; *technical* refers to knowledge of technology used by the team, and *training* is provided to help the team members understand interaction within a virtual content. The Process stage has two sections, socio-emotional and task. The socio-emotional Process stage refers to relations, trust and cohesion which are all part of relational building within virtual teams. Task process refers to the task achievement and includes the communication and collaborative activity and the task-technology fit. Critical here is the suitability of the fit between the team tasks and the technology that is used. The final stage, the Output stage, is described in terms of personal satisfaction and team performance, demonstrating the importance of the individual in teamwork tasks.

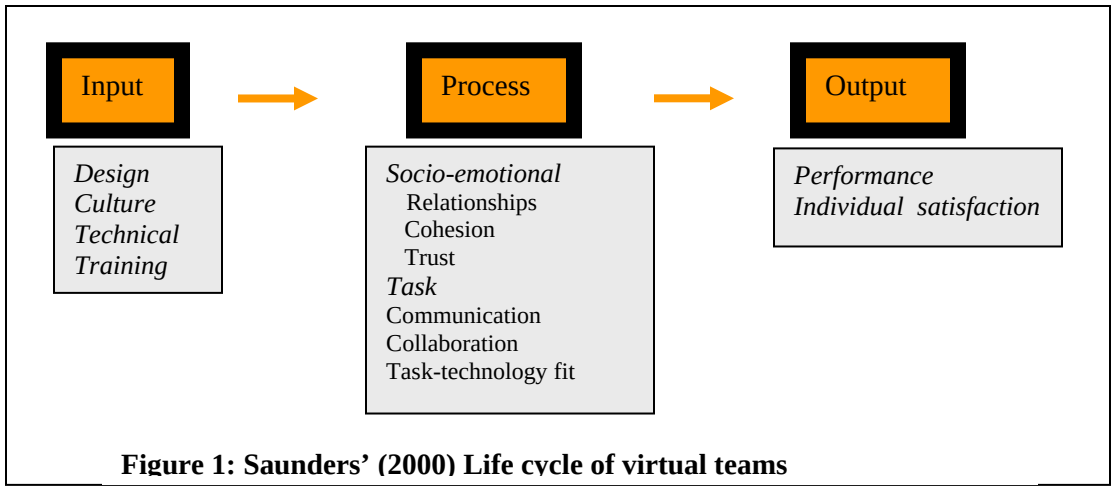

Figure 1: Saunders' (2000) Life cycle of virtual teams

In reviewing this meta-study, and in re-reading some of the original studies and others relevant reports, the author sought to clarify key factors for success, using Powell et al's framing. These are discussed here to provide the reader a means to measure the success of the virtual team environment presented in this case study.

'Success' indicators for the Input stage

- Team design, team training directly affects the process and output stage. Common agreement of the team's task and individual roles varies according to personal goals and agendas evident from the start of the team life-cycle.
- Loughran(2004) suggests that individuals as well as teams need to benefit from the initial interaction. Positive first impressions (Coppola 2004) will aid this process.
- Culture tends to affect the task process and not the socio-emotional process. Inadequate understanding of a team member's background is an extreme problem for dispersed student based teams as it is for global teams. The challenge is to find ways through the interactions with technology in order to improve awareness of individual differences.
- Technical competency affects team trust and individual overall satisfaction, thus opportunities to build technical training are needed

'Success' indicators for the Process stage

- Establishing social capital (Pauleen 2004) in managing distant relationships is critical to team interactions. Inclusiveness in conversation builds a sense of community and trust (Kimble, Li, & Barlow 2004). Ongoing trust include the identification of commonalities between members, performing competently, displaying concern between members and acting with integrity (Duarte & Snyder,1999).
- Trust behaviour in the short-cycle virtual team space is described as *swift* trust (Jarvenpaa, Knoll & Leidner, 1998) as it tends to be predominately task focused with positive expectations of other team members reliability based on very little real information. This trust amongst team members tends to be quickly lost when team members do not cooperate as expected.
- Virtual teams have immense communication problems due to the lack of face-to-face interaction. It is critical that contextual information such as workload, personal perspectives, outside factors as they affect the teamwork is conveyed to the virtual team (Loughran 2004).
- High performing teams built communication based on social exchanges and coped with technical and task uncertainty (Jarvenpaa & Leidner,1999)
  - Individuals took the initiative suggested topics and volunteered for tasks.
  - Communication processes become predictive and regular, with warnings of absences.

- Regular feedback, substantive and timely, or indicative that the messages were read with activity to come at a later time.
- Members rotated leadership if it existed at all, moved from a rule based team behaviour to task processes and achievement, were slow to react to crisis and had the ability to ride out team problems.

'Success' indicators for the Output

- Task and socio-emotional processes is directly linked to performance output.
- Task-technology- structure aligns to both aspects of Output, Performance and Individual satisfaction.

Using these guides for team success, it can be seen that two team processes are needed. It is critical to build the relationship side for team members to work cohesively in a virtual environment.. Team tasks needs to be carefully aligned to the technology used to achieve these tasks. Teams need careful guidance on methods of interaction, building parallels between face to face teamwork and virtual teamwork. Thus by training students to consider social demands within communication and collaborative practices of virtual teamwork, team trust and relationships can be enhanced.

This paper attends to the social aspects of virtual interaction, particularly in the relational formation in teamwork. By applying the concepts of the three social mechanisms for communication and collaboration to guide students with their interactions, the relational building aspects of the team life cycle can be developed.

Social Mechanisms of Communication and Collaboration

The three social mechanisms that are covered in this study address the concept of conversation, awareness and coordination. All three concepts are necessary in building relationships with common goals, developing effective communication, and sharing tasks with effective coordination.

The key ideas for face-to-face interaction extracted from Preece, Rogers and Sharp (2002) that may be useful for virtual team working and relationship building are developed below:

- *Conversation* is how people carry on a discussion. One needs to consider the rules of interaction, the implicit or explicit cues, formal or informal language, and type of interaction (synchronous or asynchronous), number of people in the conversation and dealing with breakdowns and repair mechanisms that may be required.
- *Awareness* refers to the observations we make when in a collaborative space such as "who is around, what is happening, and who is speaking to whom (Dourish & Bly, 1992)" (Preece et al. 2002, p.124).
- *Coordination* includes examination of shared understandings, schedules, rules and conventions that are used and external representations. Coordination takes place when a group of people act or interact together to achieve something. Collaborative activities require team members to coordinate with each other.

The course taught to students in Human Computer Interaction, considers the technical implications for the design of communication and collaboration technology. Preece et al (2002, p.105) argue that "*human are inherently social. It seems only natural, therefore, to develop interactive strategies that support and extend these different kinds of sociality*." This same argument is used to develop social strategy for relationship building in virtual teamwork.

Research Question and Study

Hentttonen and Blomqsvt (2005, p107) argue that "*Information technology plays an important role in virtual teams, but virtual teamwork involves significant social redesign*". The research

design for this study addresses this issue of social redesign by developing strategies that allow the student to understand the activities required of teamwork at each stage of the virtual team lifecycle. By linking the concepts behind the study of social mechanisms of communication and collaboration to virtual teamwork, social issues in interaction will come to the fore.

Hence, given the pedagogical strategy of introducing reflective logs into the course assessment that enable students to build student understanding of the social mechanisms both in their technological use and in team work, the research questions that need answering are:

(1) is interaction in the virtual team environment more successful when the three social mechanisms of communication and collaboration are applied?

(2) do the reflective logs provide evidence of team building relationships over the team life cycle?

To answer these questions, this case study presents the student reflections on use of the three social mechanisms of communication and collaboration in their virtual teamwork. As such the study will focus on individual reflective documentation. This is presented as individual logs over the team life cycle and final reflections of team successes.

Context: The Assessment Design

The pedagogical goal of this assignment was to engage students in online technology in order to understand the design requirements for developing technology for social communication and collaboration. Individual and virtual team work was the vehicle for this process. Teams presented seminars of topics within the course while peers provide feedback by reviewing their work. This is done at a shared team website, designed to cater for groups of six teams with a maximum team size of four members. A final team report summarizes this feedback and identifies communication strategies to improve the presentations, as well as examine issues in the design of collaborative technologies. The individual component requires students to complete a series of reflective logs reviewing the three mechanisms of communication and collaboration in team tasks and virtual environment. In their final report, each student presents an overall reflection on team working: positive, negatives and success factors for virtual team working.

This design is the result of ongoing action-research process that examines a series of iterations in teaching approach with virtual teamwork (see Egea 2003, 2005; Egea & Gregor 2002). Team shared workspaces were initially small email lists followed by a specially designed shared website. After reviewing the personal satisfaction outcomes from these earlier course models, a more direct approach in building the relationship aspect was designed. Indicators from previous successful teams revealed that the three mechanisms of communication and collaboration naturally took place. By introducing a structured focus on the social mechanisms of communication and collaboration, the current course design developed.

The three reflective logs were due at the each stage of the team life cycle, that is input (getting to know each other and share understandings of the team tasks), the process stage (both socio-emotional and task process) and the output stage (performance and individual satisfaction). Each reflective log was required to rephrase the definitions of each social mechanism and note their relevance and possibly application to the team relationship. The final report after the team activity was completed, required students to summarise their logs in terms of team working, comment on positive achievements of the team experience, things to avoid in teamwork and identify the characteristics of successful virtual working.

Supporting the training aspect of the input stage in the team life cycle, online tutorials were available on team work issues. They aimed at developing and improving team communication and collaboration. Topics covered include the need for a joint purpose, communication, feedback,

support and assistance, and discussed how to negotiate and deal with complexity and problem solving. Virtual teamwork guidelines were also provided based on the work of Walter, Boos and Jonas (2002). While these addressed similar topics, the virtual component stressed the value of frequent communication, confirmation receipts for incoming messages, team inclusion, early and continuous work on projects, explicitness of meaning, and creating early deadlines and adherence to them. It is noted that these supportive tools were recommended in earlier years with limited success, possibly due to the lack of integration of these tools into the assessment process.

Other support included a virtual introduction template, a simulation on the shared team website and a tutorial on presentation considerations in PowerPoint slide design.

The Starting Point: Input

In week 1 of the term, 28 remote students (within Australia) were enrolled in the flexible program. At the end of week 2, when the teams were allocated, one student had requested that he work alone, four students had joined from Singapore, and five students had dropped the course. Since the assignment design was based on groups of 6 teams, and that past experience indicated that optimal team size was not larger than four students, two groups of 6 teams were created. Teams were grouped based on their geographic location to enable the possibility of face to face interaction and cheaper phone calls.

Students were advised of their teams at the end of week 2. However, following some more student attrition, team size was reduced to 3 teams of three students, seven teams of two students and two students worked alone. Gender of the teams is indicated below in Table 1, along with the coding used to represent the individual student in the case study.

Table 1: Team nomenclature and student code with gender

FLEX	Group 2- student code	FLEX	Group 3
Team 1	g2t1p1(F), g2t1p2 (F), g2t1p3(M)	Team 1	g3t1p1(F), g3t1p2 (M)
Team 2	g2t2p1(F), g2t2p2 (M), g2t2p3(F)	Team 2	g3t2p1(F), g3t2p2 (F)
Team 3	g2t3p1(M), g2t3p2 (M), g2t3p3(M)	Team 3	g3t3p1(F)
Team 4	g2t4p1(F), g2t4p2 (F)	Team 4	g3t4p1(F), g3t4p2 (F)
Team 5	g2t5p1(M), g2t5p2 (M)	Team 5	g3t5p1(M), g3t5p2 (M)
Team 6	g2t6p1(F), g2t6p2 (M)	Team 6	g3t6p1(M)

Code: M= Male; F = Female, g= group, t = team, and p = person

The resulting demographic information includes:

- Gender: 12 females and 13 males
  - While teams were linked by geographical location, teams were both mixed gender and single gender composition
- Discipline: undergraduate students
  - Seven students were from second and third year Information Technology, eight students were fourth year Information Systems and Accounting; five students in Multi-media; four students in Information Systems, and one student from Health Informatics.
- Age: most students in FLEX mode at the university are over 25 years and under 45 years.
- Geographical location: while students were dispersed throughout Australia and Singapore, most students were within 50 kilometers of each other.
- Work: 20 students worked full time

- Study: All 25 students were part time students studying remotely. Students tend to take two or three courses in part-time mode.
- Other: 1 student (g3t4p2) a full time single mother with a four year old child

What Was Achieved

Submissions

All teams submitted seminars and peer reviews on time at the shared team website for each group. It is noted that this occurred consecutively over a period of six weeks, from week 5 to week 10. Only one team (group 2, team 4) that did not complete the entire set of peer reviews.

Logs were due and submitted in weeks 4 (introduction), week 7 (process of developing team task), in week 10 (process of team task) with the final report on teamwork activity was due in week 11. Twenty-four students completed the three logs (not student g2t4p1), and a different set of 24 students submitted the final reports.

Logs ranged in word count from 100 words to 1172 with most being between 400 and 600 words. The complexity of these reports was most surprising as the actual mark for the three logs was only 5 marks. This suggests that student motivation to complete the tasks is significant. However, two students (g2t4p1 and g3t4p1) only completed log 3. Team 4 in group 2 was a very poor performing team and in group 3, team 4 had the one member, who also performed very poorly. Both students received the poorest marks in the flex mode grouping.

Only three students did not complete any formal introduction of which two were in the teams of 'one'. Students mainly followed the ideas in the Introductory Proforma. A wealth of information was supplied, including individual photos in half the log 1 submissions.

While most teams had members in close geographical location, no team meet on a face-to-face level. Similarly, most teams avoided phone usage, unless it was needed for an urgent response, as with the Singapore students. Powell et al. (2004) advise initial face-to-face interaction if available. All, but one, virtual teams used technology for their communication despite the close proximity of the students. In one situation (group 3 team 1), poor communicative process and the urgency of the team task was relieved with face-to-face contact.

Interaction

Interaction was primarily virtual for the teams in Australia. One team (group 2, team 2) was composed of a husband (p2) and wife (p1) team and one other (p3) was remote. The four Singapore students engaged in both face-to-face and virtual interaction. The resulting breakup is defined for this study as *virtual* and *virtual and face-to-face* groups, used in a following section.

In contrast to early offerings of the course, all flex-mode and Singapore students remained in the course and all passed the assignment and the course. Student results for the course improve significantly to prior offering for this student group, by 25%. It is suggested that the teamwork has help to motivate the students and learn from each other, particular as the socio-emotional aspects develop. This supports the discussion of Hollenbeck, DeRue and Guzzo (2004) who present findings that face-to-face teams trained together, perform better than individual based learning. They indicate that the shared understanding of the task results in better performance. Linked to the team life cycle, this suggests that individual satisfaction is improved (Powell et al. 2004).

Use of technology

Email and chat technology were commonly used for interaction for all teams. Synchronous technology was usually used for introductions, brainstorming and in one case as the regular weekly

online meeting (group 3, team 4), while email was used to record meeting outcomes from synchronous meetings and to transfer files.

> This high level of communication as described in the reflective logs through the term was achieved primarily via email and constant MSN Messenger Chat. Without this constant conversation regarding workload, useful information group members attained and general issues of concern the work required could have easily become out of control and due dates not met. (report, g2t3p1)

Some students indicated their unfamiliarity with various technologies but were prepared to learn from other team members or experiment more widely with available collaborative technologies, such as Yahoo Briefcase and synchronous commutative technologies as Yahoo Messenger. The need for technical training and its link to team trust and overall satisfaction (Powell et al. 2004) was addressed through students taking the initiative as shown here. However future developments might use the various technology tools as part of the assignment design.

Having set the context for the team activity, and the task related outcomes achieved, the next sections will show that the three mechanisms become a tool for team engagement, supporting teams with guidelines useful for successful interaction and building the socio-emotional process stage that of relationships, social cohesion and trust.

Conversation, Awareness and Coordination

Using the framework of Preece et al (2002), each social mechanism of communication and collaboration (*conversation, awareness and coordination*) is presented from the student's perspective and team interactivity, particularly relationship building.

Conversation

Students were asked to compare their virtual interactions with face-to-face situations and to develop understanding and strategies for three topics: flow of talk, sharing of ideas and breakdowns. This supports the virtual communication theory of Media Naturalness (DeRose, Hantula, Kock, a& D'Arcy 2004) where the least amount of cognitive effort is necessary when the virtual interaction is close to face-to-face behaviour.

Rules of conversation: flow of talk

The importance of the rules of conversation underpinned the interaction dynamic for successful team engagement and the building of positive relationships and trust. Critical to the flow of talk, whether by chat or email, was the importance of positively worded discussions and encouraging statements.

> Good team morale was achieved through supporting and encouraging each others work with side comments in a conversationary manner easing the flow of communication (log2, g2t1p1)

Further, the method to have a conversation was discussed (aligned to the work presented by Preece et al. 2004). Three rules occur in speaker dialogue: rule 1 - current speaker chooses the next speaker by raising a question, opinion or request, rule 2- another person starts talking; rule 3- the current speaker continues. One student interpreted this as

> It is important, I feel, when working via email to reply quickly and answer any question in the very first part of the reply. This equates more accurately to a face to face conversation. It is better for the person who sent the email being replied to, if any answer or comment is responded to at the beginning, thus satisfying that unfinished question loop in the senders mind. The replier can then introduce a new thought. (log 2, g3t5p1)

Individual attributes such as *respect* underlies conversation strategies of listening and replying whether using synchronous chat or asynchronous email. Several students note that different typ-

ing speeds on chat signals poor communication since each student is expressing their own ideas rather than sharing a conversation.

> Our main communication problem would be that I type a lot faster than [g3t4p2]] does and I found that I needed to slow down and let her respond before typing a new question or statement. I do not find this a negative as it makes me stop and talk the time to think about what I need to ask her next while she types. (log1, g3t4p1)

Answering questions is also an important approach.

> It is also important that all questions or comments are addressed, none left hanging. This eliminates the need to have to re-ask., which leads to confusion and possible frustration. (log 2, g3t5p1)

Sharing of ideas

Rules that built engagement for sharing of ideas included careful and concise language, emails were constructed to reply or create new topics, and individuals need to be willing to ask for clarification. Students wrote of the importance of clear communication and to address breakdowns through open and frank feedback. For example,

> The conversation for the preparation for the team presentation was again kept informal, but clear and direct by the way of email only. As both members were aware of the limitations of email as a conversation media, the 'tone' of the messages were kept light and encouraging so there was no misunderstanding regarding the intentions of the members conversation. (log2, g3t2p2)

Misunderstandings/Breakdowns

When addressing potential misunderstandings, it was necessary to seek clarification and use discernment, with careful consideration of the intention behind the comment. For example,

> However, conversational mechanisms were particularly noticed as the majority of conversation between group members was via email rather than face to face. As a result it was even more important to make sure instructions and questions were clear so that no misconceptions or misunderstandings would occur. It was necessary to facilitate the conversation to ensure problems were avoided. All group members successfully implemented this and maintained close contact and continued to support and assist other group members throughout the project. (log2, g2t1p2).

Critical to virtual working and relationship build, the social mechanism, of conversation requires written interaction to be careful written with clear, concise, flowing and respectful approach. This supports Walter et al. (2002) findings that communication in a virtual environment requires a greater level of explicitness than in a face-to-face environments.

Awareness

While the definitions of a*wareness* state 'knowing who is around, what is happening, and who is talking with whom' Dourish and Bly (1992) cited in Preece et al. (2002, p. 124), students described their awareness initially in terms of the mental pictures they generate of team members, through their style of conversation and the *Introductory Proforma*. Team bonding builds from awareness as team members identify with each other; provide regular updates on tasks and outside commitments and show concern and support. Relationship development is well supported by *awareness*.

Contact and introductions

The use of email as a collaborative tool provides limited awareness. Student g2t5p1 relates conversational process to build awareness of each team member. He states:

> Awareness suffers greatly in an email collaboration. There is no opportunity to here a voice, see an expression or observe body language. This makes it very important to choose words carefully and to phrase

> things appropriately. One incorrect word hanging on the page can be misinterpreted with unpredictable consequences. (log 2, g3t5p1).

Early contact was critical to team building (Loughram 2004; Walter et al. 2002). The use of the Introductory Proforma template was popular and supported this identification process. Most students used the ideas of the template or the template itself, and send this as an email attachment or used the ideas in their first synchronous discussion.

Besides providing contact information, students provided detailed descriptions of their past activity with teamwork, work demands, achievements in course of study and contact schedules. They explored cultural backgrounds, particularly though shared academic pathways, place of work and place of living. Some members shared photographs with other team members.

> Sending personal proformas was a good way of introducing team members to each other, it gave us a chance to identify with team members. (report, g2t2p3)

Thus it would appear that students benefit by having aids for introduction to start the conversation and build awareness of each other.

Team bonding

First impressions built from initial virtual interaction were critical to the formation of trust or lack of it, as mentioned by Meyerson et al. (1996, p.6) – "*unless one trusts quickly, one may never trust at all*." In the case of teams that had to develop their task of seminar presentation as well as understanding the motivations, strengths, commitments of team members, these initial interactions are essential to the relationship development between team members.

> [g2t1p2] was very forthcoming from the beginning I was pleased that we were given the opportunity to work together. I was given the impression that we were both fairly organised and aware of what was required. Unfortunately I didn't get the same impression from [g2t1p3], especially since it took a week to get an initial response from him. (log 1, g2t1p1)

For those teams that were less pressured without an immediate demanding task of seminar presentation, initial contact still set the working climate:

> The feeling in this initial contact was light hearted and easy going. This was evident through the use of humour and personal anecdotes.(log 1, g3t5p1)

Inclusion, as part of a team or as part of a collective email, is important for building team motivation and cohesion. Inclusion was also noted in email signatures. Signature on the email for the husband and wife team members with their third virtual team member, allowed the receiver to understand who was sending the email.

Updates

All teams indicated the importance of updating regularly, as they need to be aware of the status of the team task. This is also very important in building relationships as it allows students to support other team members in times of need..

Updates on personal team progress, personal situations such as heavy workloads or ill members of family, help teams to become aware of what is happening with their team members, and promote levels of caring essential to the team dynamic. Addressing these areas counters the problem of lack of contextual information indicated by Loughram (2004), attends to the cultural issues noted in Powell et al (2004), and caring/support noted in Duarte and Snyder (1999).

> Individual team members continually kept other team members informed of their progress through their tasks, and if they were encountering problems with their tasks. This provided the other team members with an awareness of how the presentation was progressing overall. Continual communication via the

> two mediums utilised by our group, email and messenger, assisted the awareness of the other team members .(log 2, g2t3p2)

Further, nearly every student's comments on the importance of confirmation emails to provide feedback updates, with two students (g2t1p1 and g2t2p3) indicate that continual communication was critical to team success. It was observed that most teams created rules to support this updating process. Methods used were reply emails, text messages on mobile phones or phone calls.

The problem of multiple email addresses

Multiple email addresses, for example work email address, student email address and home email address hindered student interaction, or lack of it. To address this issue, some students developed an interaction protocol where a second communication media was used to draw attention to first communication. In this case, the student used phone calls and face-to-face interaction to solve their communication issue based on lack of awareness:

> There were no awareness mechanisms in hind sight. The impression I had of our team originally was definitely inaccurate and did not correspond to L's impression of awareness. … One person under the impression they are contributing, and not having that contribution transferred into design. The other under the impression they are doing the entire project solo. In the end it was fortunate that L returned home to Rockhampton the weekend before our presentation was due. Emails were replaced by phone calls and cross town CD deliveries, finally L felt I was doing my fair share of the work. (report, g3t1p2)

Thus, these four sections demonstrate the important of awareness for online interaction especially in teamwork and inclusive practice. The next section is coordination, which is aided by both conversation and awareness.

Coordination

The coordination mechanism required students to report on how they developed a shared understanding of the assignment tasks, what verbal and non-verbal communication was used in this process, what schedules, rules and conventions and what external representation were used as guidelines to support task achievement. To be effective in this work, attention to the socio-emotional aspects of the process is necessary. The comments selected for this section note this.

Shared understanding and negotiation

Early in the team life cycle, students noted that teamwork was enhanced by shared understanding of the required task. Saunders (2000) noted discussion in this input stage of the team life cycle was important for team success. Some students indicated that the task was difficult to understand, and valued the broader discussion that occurred in a collective grouping.

It was stated by several students that team interaction enabled problem solving skills to develop, which at time may mean conflict or criticism. The giving and receiving constructive criticism was seen as a positive indicator to ensure a better overall task completion. Relational communication and trust underlie these processes.

The importance of choice was noted in collaborative and cohesive teams. Teams with self nominated leaders tended to dictate tasks and have less levels of team satisfaction.

Verbal and non-verbal communication

Explicit structures coordinate the activities overcoming lack of face-to-face cues, in terms of coordination of activities. The use of a shared website supported this function for many students.

> The use of the team website for collaboration was also a great idea. The use of this website allowed group members access to the submitted presentations, the related reviews and other information specifically

> relating to the coarse. The main benefit of this is that all the work relating to this particular assignment is kept in the one spot and students wishing to obtain this information need not have to be on campus or on one specified computer to have access. (log3, g3t5p2)

Despite working in face-to-face teams in her work, one team member noted her skill transferal was limited by the lack of face-to-face cues and the need to have a cohesive team interaction.

> In retrospect I probably should have expressed my opinion more strongly at times. In this assignment I tended to allow my team member to have her way if that was necessary to avoid confrontation. (report, g3t4p1).

Schedules and Conventions

Teams that followed the suggested plan for coordination (shared view of team task, developed schedules of tasks with time line for allotted team members) were seen to be more active in building team relationships.

> In an environment where there is less direct contact, in our experiences we found it beneficial to pay particular attention to co-ordination. Ensuring that we both knew our responsibilities and relevant time frames proved to give us confidence in team direction. With this confidence, we understood the importance of awareness and the correct procedures to ensure it. By thoroughly co-ordinating our assignment, the preceding conversation could focus on all of the other important details, and not waste time clarifying grey areas. (report, g3t1p2)

One team member indicated that for team success, discipline was needed:

> A virtual environment requires the users to be disciplined. By this I mean that when a team member is assigned a task they must complete it to the best of their ability by the deadline that is set by the group. Our team achieved this by setting tasks and deadlines for each team member and updating our fellow team-mates on where we are with each task. (report, g2t2p3)

Team members appeared quite willing to share and provide individual support where necessary, which in the following situation, extending the student's understanding of her own abilities:

> .. because of [g3t2p2]'s busy work schedule I found myself picking up the reigns. This has given me more experience in leadership, encouraging others, time management and assertiveness. (report, g3t2p1)

As many of the students were in full time employment, it was critical that teams were able to adjust with others coming in to support and assist. In general, for teams with a socio-emotional focus, high level of cohesion resulted from this support.

External representations

These representations were the virtual method that students shared their list of tasks, timelines and achievements of these tasks. For some, this was an excel spreadsheet that listed the tasks, due dates, team member responsibilities, marks, and where to submit the task. Other students depended on the shared team website as this provided immediate updates on weekly tasks that involved team members. Other students used free software such as yahoo groups for task representation. Individual logs were submitted to a course assignment page, and as such it was acknowledged only by the teaching team.

In conclusion, this section has demonstrated that the three mechanisms have been used through the team life cycle. The three mechanisms were evident in the input stage providing reflection for team design (shared understanding and getting to know each other), cultural understanding (what are the external issues that affect the student in their teams), and technical training (how to go about building skills). At the process stage, the three social mechanisms build strength in the practice of teamwork through both task and socio-emotional processes. Team trust, cohesion and

relationship strengths have each been documented in the logs and reports and presented in this section.

The last stage in the life cycle can be viewed by students' own perceptions of effective teamwork. This is the subject of the next section.

Perceptions of Effective Teamwork

As indicated in the team life cycle, outcomes have two aspects, team performance and individual satisfaction. It is shown in this section that student use of the three mechanisms in their team interaction, found the teamwork a positive experience, focused on the socio-emotional aspects of the team process stage as well as the task process, and judged success characteristics of virtual team work in terms of the three mechanisms.

To give a more balanced picture of these accounts, a picture of the constraints mix that would hinder student effort in their teamwork efforts is provided.

Based on logs and reports, constraints included technical tools (9 students), limited time (4 students), work demands (22), distance (4 students) and people in the teams (11 students). Most students recorded one or two constraints from this list, with one student (g2t3p2) affected by all the constraints in some way. One student (g2t1p1) indicated her stress at this working environment with nine comments against team members and four comments on tools.

Positive Team Experience

Students, who used the social mechanisms to guide their team interactions, generally indicate a positive team experience. Following an examination of each log and report for each student, 18 students (of 25) indicated that their current team interaction was a positive team experience; with all but one of these students utilizing the social mechanisms for relationship development to some extent in their logs.

Three distinct modes in the use of the social mechanisms towards team guidance were noted and are categories as:

- *used:* Logs that defined the meaning of the social mechanism of communication and collaboration with demonstrated application by team interaction (in teams or at team website) were considered to have used these concepts as interaction guidelines;
- *partial use*: Logs that indicated definition with limited application in their teamwork;
- *not used*: interaction processes used other rules or none at all.

A distinction is made between interaction mode, based on their level of remote activity, being *virtua*l or *face-to-face with virtual*. Figure 2 compares the use for the social mechanisms in team building with the two interaction modes. Only four students did not use any of the social interaction mechanisms for team building guidance.

Figure 3 links the students and their use of the three mechanisms in log discussion with the positive experience of teamwork. The students who has a positive team experience and used the three mechanisms (*used* or *partial use*) also wrote of stronger socio-emotional bonds. At least one member in six teams (of ten teams with two or more members) expressed an interest to work with their team member at another time.

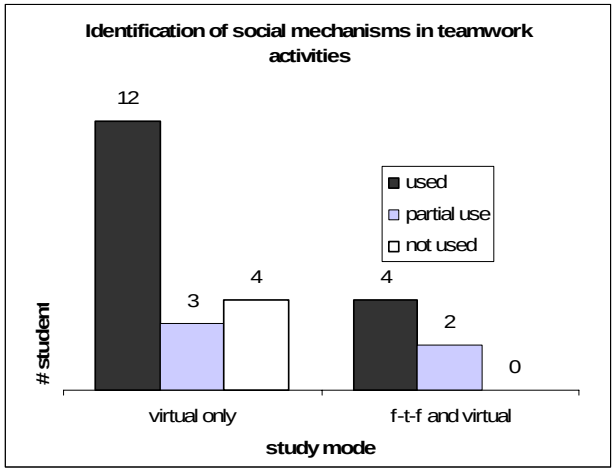

Figure 2: Student representation of guidelines from social mechanisms of communication and collaboration towards team interaction for virtual and partial virtual situations

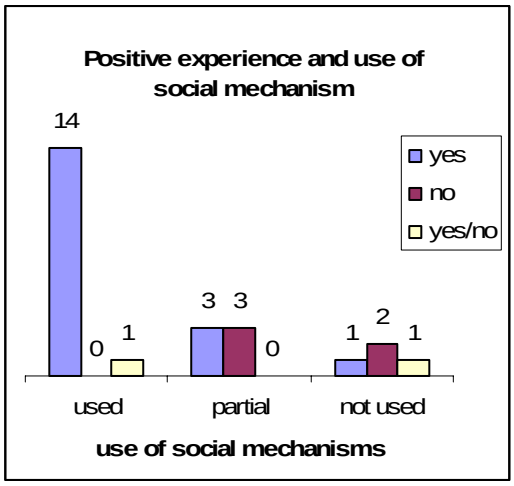

Figure 3: Student indication of positive experience (yes, no, yes/no) with use of guidelines for guiding teamwork interaction strategies

On the other hand, those students that did not use or reference the social mechanisms to support team training (see Figure 3) found that the team work was not a positive experience. Further, the logs and reports of this student group were task focused without limited if any reference to relationship building. Interestingly, one student (g3t6p1) who requested to work on his own, developed some understanding of the social mechanism 'awareness' . This was built on his exploration on the peer review process at the shared team website.

> By reviewing others work and having ones own work reviewed an excellent dialogue takes places whereby the awareness of how others approach a problem is heightened. (log 3)

Of the four students who did not use the mechanisms (see Figure 2), one student (g2t2p3) followed the same pattern as she conducted in her work with global teams, rather than the suggested pattern of social mechanisms for communication and collaboration. She indicated that her tools of interaction were email, internet and the phone since it "*fits into work and lifestyle commitments*." However, when results were unsatisfactory, she would "*meet face-to-face to complete the project*." The other two students did not use any guidelines and were dissatisfied with the team process.

Another student (g2t1p1) changed her attitude towards her team outcomes and individual team member, indicating an intolerant approach to team members who had a high workload:

> Log1 reflection in report- It is at this early stage that [g2t1p3] (once he did find time to contact the group) indicates how busy he is at work. That did start things off badly between him and I because whilst I can appreciate how busy [g2t1p3] is, everyone has commitments and if you can't contribute like everyone else you shouldn't be enrolled in the first place.

> Log 2- 'I have worked in a lot of groups for this degree and have found that that considering the amount of interaction we have had as a team, we have worked very well together to complete the tasks as given.'

> Log 3 –'Why [g2t1p3] left his small part until the day before is beyond me and I was less than sympathetic when he said he may not be able to complete it. It is instances like this that leave my opinion of group work low.)

On the other hand, there are numerous examples of trust, cohesion and relationships providing evidence that socio-emotional links were being developed in the interaction process. For example, members of two different teams state the following:

> Trust between the two members was established early as insight into personal experiences was provided in this first interaction.(report: gr2t5p1)

> Good team morale was achieved through supporting and encouraging each others work with side comments in a conversationary(sic) manner easing the flow of communication. (report: g2t2p1)

It would seem that the guided reflection and implementation of the suggested strategies within the mechanisms support teamwork interaction as well as to individuals communicating and collaborative online.

> Positive outcomes gained from working as a team include;
>
> - Ability to generate and explore a greater number of ideas.
> - Ability to then pick and used the best ideas
> - Sharing of experience and knowledge between team members. This helps in the ability to generate more ideas and explore possibilities that may otherwise be missed by one person. Also in providing clarification through discussion of task and methods for completion.
> - Ability to Share the work load for a project
> - A motivating factor to complete the tasks so as not to let down other team member(s). (report, group 3, team 5)

Finally, it is noted that several students changed their opinion about virtual teamwork, for example:

> Before the start of this course I dreaded group assignments. I had always found that the other team members usually did not use the facilities available to the full extent, which made communication difficult and often meant that I carried more of the workload to ensure that I passed. This team, however, has convinced me that it is possible to work in a totally virtual environment. When goals and rules are set at the beginning and all members adhere to this, then everything runs quite smoothly. (report, g3t2p2)

Student Classification of Team Success Factors

A second study analyzed student reports on success factors for virtual teamwork. Half the students highlighted the three social mechanisms of communication and collaboration as a key characteristic for success team working in a virtual environment. The following student's conclusion provides one such analysis:

> Team Four's collaboration and communication for the second assessment for the course Human Computer Interaction was a great success. Conversations through email and online chat were a triumph to aiding the completion of all the pieces of assessment involved. Team members had to have an awareness of team member's attitudes and abilities to complete the work and the restrictions of the chosen communication technologies. Coordination was a high priority with completing the activities as a team, with work equally distributed and by the due dates.(g3t4p2).

There is also an association between these students and a relationship preference that builds social –emotional practices alongside the task process of achieving the final goal. This supports the research of Kayworth and Leidner (2000) where individual team members were seen to be more satisfied when more communication methods are used in virtual team interaction.

> Another positive is the social interaction provided by the communication necessary in completing team work. As an external student I found this aspect to be especially true. (report: g3t5p1)

The other half of students defined success factors in terms of communication, use of collaborative technology, characteristics of the individual or more lecturer direction. Figure 4 compares the relative values of each of these characteristics.

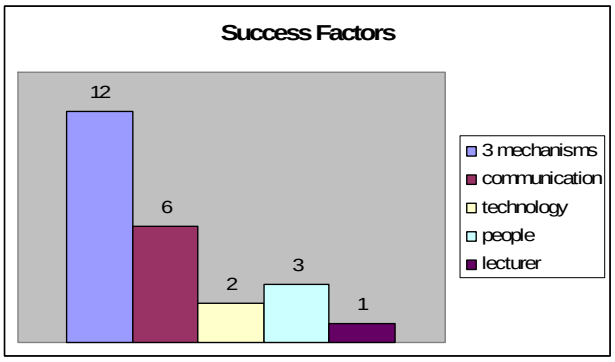

Figure 4: Student view of success factors in virtual teams

However, those who focused on communication, technology and people demonstrated little socio-emotional interest, and a strong preference for task process. For them, the primary purpose of the team appears to be the achievement of the team task with particular attention to use of technology for communication and collaboration.

The additional characteristics required when a team such as this is placed in a totally virtual environment, such as this team was, is to secure stable and effective communication methods. Multiple methods should be made available, as particular methods suit particular types of communication. (g2t3p2)

In conclusion, the student perception of success, whether it be a positive team environment, or their own success in the team activity, highlight the importance of the reflective log approach on the three social mechanisms of communication and collaboration to understanding the dynamics of team work.

Discussion and Conclusion

This paper documents a case study that implements an assessment instrument that incorporates team building throughout the team life cycle. The study shows that the use of the three reflective logs on each social mechanisms (*conversation, awareness and coordination*), has provided the students with a process to successful interact online in a virtual team. The comments raised by students on these mechanisms provide evidence of student engagement in the virtual team process and address many of the success factors identified earlier in the literature.

Positive student feedback on personal satisfaction and team success characteristics provides the reader with more evidence that team building and relationship development has occurred. It is also worthy to note the relationship between the three mechanisms appear to act as a tool for interaction, highlighting the socio-emotional processes that build team relationships, cohesion and trust. Further, the general theme for successful virtual team characteristics integrates an understanding of the social mechanisms of communication and collaboration.

It is therefore suggested that based on this student data, the two research questions are affirmed in the context of this course. The virtual team environment is perceived by the students to be more successful when students apply the three social mechanisms of communication and collaboration to their team building. Personal logs build stronger team relationships and engage students in more effective team work creating a balance between task achievement and working cohesively.

This work needs replication in other disciplines that use virtual teamwork to determine if this outcome is valid. Utilising the same model of guided reflection on the three social mechanisms of communication and collaboration (conversation, awareness and coordination) can be applied in other discipline areas with adult learners. It is important though that the logs are a documentation

of reflected practice, such that they personally apply the social mechanisms to their own collaborative work.

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Biography

Since 2000, Dr. **Kathy Egea** has been a senior lecturer at Central Queensland University. She has worked with undergraduate technology students to develop virtual team (VT) skills in ICT environments since 2000, where her pedagogical focus includes individual reflective process, experiential learning and guided lecturer support. This teaching and learning strategy requires careful design, since the diverse student population undertaking her course in Human Computer Interaction is both domestic and international, spread across 10 internal campuses and distance learning.