COLLABORATING IN VIRTUAL TEAMS

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Abstract.

This paper describes some early results from observing and interviewing groups working to achieve intellectually complex tasks that required the use of computers, WWW and other research resources. Three groups were virtual (they were working at a distance and rarely meeting face to face) and two groups were simple control groups They were real groups (working in relatively close proximity so that face to face contact was possible most of the time). All five teams completed their tasks but a subjective assessment suggests that both the real teams performed better than the three Virtual Teams. The virtual groups appeared to take considerably longer to form and norm and all of the members of the virtual teams felt that limited time hindered their progress although the real teams did not feel this.

Introduction

This paper describes some early results and conclusions from observing and interviewing groups working to achieve intellectually complex tasks that required the use of computers, the WWW and other research resources. Three groups of three or four people were virtual (they were working at a distance and rarely meeting face to face) and two groups were simple control group. They were real groups (working in relatively close proximity so that face to face contact was possible most of the time).

The task set for each of the five groups was to create a summary of knowledge technologies by investigating 30 listed sites on the WWW and then select other sites if necessary in order to answer the question "what jobs do these different technologies do"?

All the teams completed the task but a subjective assessment suggests that the real teams performed better than the Virtual Teams. The teams reflected on the process after the event in interviews and questionnaires and this paper reports on those reflections.

Collaborating in an Internet Team provided motivation at a distance for some people although some teams contained people who did not participate or become part of the team. Styles & perspectives would not have been made explicit if the virtual groups had not been formed and added value compared to the individual members working separately to achieve completely separate parts of the task.

Teams constructed understanding although different people had different filters and different maps of the world and the task. Virtual teams developed generic subjectivity by arguing, expecting, committing and manipulating. All the teams appeared to create and become new communities of practice.

Weick(1979), Nonaka & Takeuchi(1995) and Nonaka(1994) provided some theoretical criteria to assess the cost of knowledge and these were considered in this work.

All of the members of the virtual teams felt that limited time hindered their processes and progress although the real teams did not feel this, despite having the same tasks, deadlines and time-scales. The virtual groups appeared to take considerably longer to form and norm (weeks rather than hours and days) and throughout the tasks, sub-groups of the virtual teams were at different stages.

At their first meeting the teams used explicit team building process and some explicit roles were established so that people were clear about where projects were going.

After the tasks were completed, individuals in the teams reflected on how could strategies and tools could be improved. It appeared to help if the teams had met socially before the tasks. If this was not possible then team members felt that photographs and CVs may help. Once knowledge about each other was gained then teams attempted to use the advantages, skills and knowledge of individuals and the team.

The tools used by the teams were assessed by team members, including First Class, Pen + paper, E-mail, Telephone, Post, Face-to-face, Sense making and reflection, Radio cassette, Lyceum and WWW Sites. These are considered in the light of interviews with

participants and their responses to questionnaires.

The sense making process was reviewed by the members of the teams, including the use of the tools available for the tasks. Face to face meetings tended to be used where possible to agree modified categories subject to discussion with members that could not attend face-to-face meetings. Weick(1979) Enactment / Selection / Retention appeared to operate for the virtual teams within an iterative triangle.

Virtual Groups working to tight schedules left different sub-groups at different places in Forming, Storming, Norming, and Performing.

Value

Collaborating in an Internet Team provided motivation at a distance for some people although some virtual teams contained people who did not participate or become part of the team (that is they had two communications or less with the rest of their team).

Learning about the subject matter resulted from practice, and sharing ideas and information forced making tacit information explicit, especially with other interpretations, views, sense making styles & perspectives. These styles & perspectives would not have been made explicit if the virtual groups had not been formed and added value compared to the individual members working separately to achieve completely separate parts of the task.

Socialisation transformed tacit knowledge to explicit knowledge [Nanoka & Takeuchi(1995)]. Arguing plus logical discussion [Weick(1979)] led to explicit knowledge creation at generic subjective level [Wiley(1988)] and feedback [Shannon & Weaver (1949)].

The virtual teams tended to have their interactions automatically logged and recorded by the systems {although not minuted}. The real teams tended to minute meetings.

All five teams completed the tasks and the goal partly drove process for all the teams [Dervin(1999)] and the whole process was Mode 2 learning [Gibbons(2001)] and active learning.

The teams reflected on the process after the event and in interviews and questionnaires suggested that they had learnt the key concept of sense making largely through processes similar to those described by Weick(1979) and Weick(1995):

> ➢ Belief driven:
> • Arguing – reasoning, from one idea to

choice of another.
 • Expecting – confirming.
➢ Action driven:
 • Committing – built meaning around the tasks as commitment built.
 • Manipulating – created a comprehensible & manageable group environment.

Weick drawing on Wiley(1988) also suggested levels that were working above the individual and Intersubjective and generic subjective levels appeared to have been achieved by the Virtual Teams:

 • Intersubjective – synthesis of self = I-We {individual thoughts/feelings/intentions}
 • Generic Subjective – people interacted to create group meaning.
 • Extrasubjective – not achieved.

The real teams appeared to achieve all the subjective levels of Weick and Wiley: intersubjective, generic subjective and extrasubjective.

Through the constructionists model the teams constructed understanding although different people had different filters and different maps of the world and the task. The real teams approached the 'oneness' of Japanese tradition [Nonaka & Takeuchi(1995)] and tended to use a process similar to Choo's Iterative Sense Making model (1999):

 • Enactment constructed, rearranged and reordered raw data.
 • Selection matched enacted raw data to current understanding.
 • Teams sought to select and impose meaning to retain a sensible rendition of previous events.

The virtual teams developed generic subjectivity by arguing, expecting, committing and manipulating (Weick, 1995). All five teams created new communities of practice [Brown & Duguid(1991)]. These communities of practice appeared to continue to function after teams had completed their tasks (with the exception of those members of the virtual teams that had not taken part or that were felt not to have pulled-their-weight by the other members of the virtual teams). The real teams appeared to be more forgiving of members that did not complete work on time than the virtual teams.

Costs

Weick and Nonaka & Takeuchi provided theoretical criteria to assess the cost of knowledge and these were considered in this work.

The Virtual Teams tended to rush in without establishing a viable team process. All virtual team members mentioned something like this but all felt that this was a lesson learned and that in future teams, more time would be spent planning and establishing ground rules. The virtual groups sent a lot of E-mails about the tasks (more than two per day per person) but in a lot of cases this appeared to be noise rather than communication. A review of email correspondence suggested that at least some were an attempt to persuade others that individuals were doing something or just to talk, rather than any constructive work.

All of the members of the virtual teams felt that limited time hindered their processes and progress although the real teams did not feel this, despite having the same tasks, deadlines and time-scales. Much effort appeared to be expended by the virtual teams in rendering tacit information explicit and in learning the software to use in order to work at a distance {First Class, Lyceum, and email facilities}. In some case hardware needed to be purchased and installed {sound cards, modems and extra hard disks}. This all led to transaction costs and costs of training and adaptation.

The virtual groups appeared to take considerably longer to form and norm (weeks rather than hours and days) and throughout the tasks, sub-groups of the virtual teams were at different stages. In comparison, the real teams appeared to keep all members at the same stage throughout the tasks. This was achieved in the real teams by face-to-face meetings (scheduled and accidental) and by individual members of the teams helping to complete tasks assigned to other team members or by transferring sub-tasks from person to person when necessary. The virtual teams tended to assign tasks and then wait until deadlines passed before realising that some team members had not completed work. When this happened, the work tended to be reassigned to other members of the team and some animosity resulted.

On reflection, most of the virtual team members felt that they should have cut "extra slack" for some team members in order to avoid misunderstandings and to encourage participation. When team members were felt by others to have failed to perform to satisfactory standards then they were sometimes alienated quickly and not trusted again. This was different in the real groups where more understanding appeared to be shown, mistakes were tolerated and work was reallocated earlier.

Cartesian anxiety formed from the need for a world of pre-given features and ready-made information [Weick]. Sharing made security impossible and although this appeared to be accepted by members of the real teams, members of the virtual teams appeared to feel a greater ownership of their own individual work. In some case team members did not want to share their work with other that were perceived as not performing to the group (or sometimes individual) standard.

The virtual teams felt burdened with learning jargon and codes and appeared to have a higher risk of misunderstanding and communication breakdown. They had more problems in learning the different realities of team members and in the use of Bennett's model [Bennett (1987)].

An advantage of working in the virtual teams was that expertise became available without the usual costs of travel and arrangement costs across different countries.

Strategies

At an initial face-to-face meeting for all of the groups, the teams discussed strategies. All were guided to consider Adair's task, team and individual and Kolb's cycle [Kolb(1984)] against team skills and individual skills. They established an awareness of preferences and some used knowledge of Myers Briggs, Kiersey Temperament Sorter and Belbin Type indicators (*although some members did not know these or could not / did not produce them*).

Spradley(1979) suggests that knowledge and understanding tends to depend on categorisation, at least at the early stages, so all the teams allocated different parts of the job (investigating different sites) to individuals to review and report. In some cases these overlapped so that individuals reviewed two sets in order to provide redundancy and a second opinion. Some team members volunteered for more work than in others.

At their first meeting the teams used explicit team building process and this appeared to be useful in building the virtual teams later. Some explicit roles were established (resource getting, timekeeper, finisher etc) and this appeared to be a valuable way of ensuring that people were clear about contributions and where projects were going.

Broad but clear project planning guidelines tended to keep teams on track, for example, the knowledge to be created was context sensitive so the groups tried to agree context at early stages. The real teams tended to guard against the danger of doing and not thinking while the virtual teams often appeared to be doing a lot but appeared to be thinking very little. All the teams considered and observed themselves moving through Tuckman's Forming, Storming, Norming & Performing although the virtual teams found this process more complex and difficult than the real teams.

How could strategies & tools be improved?

It appeared to help if the teams had met socially before the tasks in order to start forming {getting to know each other} early. If this was not possible then team members felt that photographs and CVs may help.

The virtual teams felt that it was difficult to create a sense of urgency and synergy and even when a sense of urgency appeared to exist in the individuals, they could not see it in each other or in their team.

As knowledge management may be about 70% people [Baker(1998)] and only about 33% technology [Davenport & Prusak(1998)] then teams felt that they should have tried to know more about each other and could have extracted more information about each other.

Once knowledge about each other was gained then teams attempted to use the advantages, skills and knowledge of individuals and the team [Smith & Irving(1997)].

One team that issued early Agendas for Lyceum meetings appeared to work more efficiently in that media than the other two. The other two appeared to spend most of the time playing with the technology.

Teams that exchanged (and read) material before synchronous discussions appeared to perform better in that they made more decisions and set more deadlines for completion of work (one real team and one virtual team).

Knowledge involves power and although all the individuals that participated appeared to trade knowledge within their own teams and occasionally between teams, the virtual teams appeared to be less willing to do this.

All the individual team members recognised that they needed to be reflective practitioners but the virtual teams appeared to spend too much time reflecting and not enough time doing and the real teams appeared to spend all the time doing with little reflection.

The members of the virtual teams felt that they needed to include extra procedures and rules for communication and some effort was expended in this way.

Tools

Tools used by the teams included:

- First Class
- Pen + paper
- E-mail
- Telephone
- Post
- Face-to-face
- *Sense making and reflection*
- Radio cassette
- Lyceum
- WWW Sites

These are considered below in the light of interviews with participants and their responses to questionnaires.

First Class. This was asynchronous communication and meant that time did not have to be booked (SMCR) although it was less secure than some other means. This media provided valuable thinking time between communications and tended to involve the whole team, sometimes for semi-synchronous chat. Some communication was open communication available to all the teams and other users of the system and this suited teams with a sharing policy. The history function in First Class meant that individuals could see who had read their emails and when. This was interesting when team members that did not contribute to the team effort were still seen to be reading messages and information. The communication had little receiver control as the sender decided who would be sent the message in the first instance but the system preserved messages [Schramm(1973)] for future reference, modification or use.

Pen and paper. Pen and paper was seen as reliable and familiar. No training (or training time) was required but communication was slow and difficult to update. The media provided touch but no sound. Like First Class, the media meant that messages were preserved but tended to be private and separate rather than to groups of people.

E-mail. E-mail was familiar to most of the individuals in the group and required little training time. E-mail reached further than First Class but still provided valuable thinking time (it was asynchronous). The media was more secure but often involved the whole team. Considering SMCR, there was little receiver control although the communication was one - to - many. The senses had no sight or sound feedback although the text is the whole message [Open University 2]. Feedback was slow but messages via email were given a high status.

Telephone. The telephone was tried, tested and reliable. All the team members trusted the media and used it for urgent communication, for example when one virtual team was spreading a virus. Sometimes members did not provide a contact telephone number and the medium lacked visual feedback [Schramm(1973)] but did include intonation and

volume. The medium was 1-to-1 and transient with immediate sound feedback. Communication was sometimes regarded as lower status.

Post. Post was slow and often only used as a last resort. The post had little receiver control and did not use many senses. Feedback was slow and messages were considered to have a lower status. Feedback did include sight and touch.

Face-to-face meetings. This was a familiar form of communication and often led to a more relaxed discussion. Instant and full feedback was provided. Virtual teams found it difficult to arrange face-to-face meetings and some never managed to get everyone together at the same time. All the senses were affected [Schramm(1973)] and although messages were transient they were felt to have a higher status. Virtual team members that did not communicate face-to-face were jealous of meetings between other members of the team.

Sense making and reflection. Weick [Open University 3] or similar tended to be used as a model for reflection. All the individual team members recognised that they needed to be reflective practitioners but the virtual teams appeared to spend too much time reflecting and not enough time doing and the real teams appeared to spend all the time doing with little reflection.

Radio cassette. Cassettes were familiar and could be played (replayed) in cars and while travelling by train etc but had no interaction between the sender and the receiver.

Lyceum. Lyceum was difficult to use effectively and needed a lead in, substantial run in time and some training (and training time). Communication needed extra organisation and preparation before meetings. Even in the most carefully organised meetings, pregnant pauses and delays occurred with misunderstandings and silence, (although misunderstandings and silence can be communication). Communication was synchronous and/or asynchronous. Feedback needed to be more explicit than usual as team members looked for the subtle clues that were missing from normal face-to-face conversation [Hickson & Pugh(1995)]. Two virtual teams did not manage to get everyone together at the same time. Communication was fraught with technical difficulties and included many costs, including financial costs for hardware. The style of media has potential and is expected to become more popular once technical difficulties have been overcome.

WWW Sites. Individual sites were effective for sharing and making knowledge re-usable.

Sense making

At initial face-to-face meetings WWW Sites tended to be divided between team members

First Class / E-mail tended to be used to practice {forming} and for communication as social interaction [Fiske(1990)]. Some members of the teams had formed on other tasks but now had to reform with new members.

Lyceum tended to be used for further practice {forming}.

WWW / Word were used to produce situation reports {norming}.

First Class and E-mail were used to distribute reports {norming} along with post (sometimes using floppy disks).

At about this stage some members needed to overcome feelings that some team members were not investing in the task or working to the perceived team standard.

Face-to-face meetings included a discussion of Situation Reports and an update of progress.

At this stage the virtual groups all had part of the team norming and other parts still forming. From then on all the Virtual Teams had different parts of the team at different places in Forming, Storming, Norming, and Performing

First Class and E-mail were used to distribute initial sets of categories {performing}. Stories and anecdotes were beginning to be used, although some team members found these intimidating and they could have helped to create cliques.

Telephone was occasionally used, especially for urgent communications.

WWW / First Class were used to explore the other sets of categories {performing}.

First Class and E-mail were used to discuss the other sets of categories considered {re-norming}.

At this stage teams felt that communication tools and modes needed to be more familiar to them. All preferred some face-to-face contact and at least some E-mail communication.

First Class / E-mail were used to modify sets of categories.

Lyceum was used to discuss modified sets of categories but decisions tended not to be made {partly because some members could not join the discussion (or stay with the discussion all the time) due to technical difficulties.

Even at this stage, some active group members in the virtual teams were only just starting to storm.

First Class / E-mail were used to continue discussion {storming} Teams started to consider whether they recorded fewer things on conference facilities or recorded differently because Big Brother could be watching?

Face to face meetings tended to be used where possible to agree modified categories subject to discussion with members that could not attend face-to-face meetings. Attempts were made to reach agreement with these through Lyceum {performing}.

Some members of teams were partly bullied into joining late after realising their reading of First Class emails and other media recorded.

E-mail continued discussion {performing}.

Lyceum was used to modify categories to produce final categories and these were agreed by email or in face-to-face meetings {storming – politely} and E-mail was used to continue discussion {performing}. Unfreezing – changing – refreezing [Lewin(1951)]. Face-to-face meetings where possible reviewed final categories (performing} and results were place on to Concept Maps (or similar), for example the continuum from machine to people.

First Class and E-mail were used to distribute the Lyceum Concept Maps (or similar) of final categories. {performing}.

Weick(1979) Enactment / Selection / Retention appeared to operate for the virtual teams within an iterative triangle:

Virtual Groups working to tight schedules left different sub-groups at different places in Forming, Storming, Norming, and Performing.

Discussion and Conclusions

Collaborating in an Internet Team provided motivation at a distance for some people although some teams contained people who did not participate or become part of the team (that is they had two communications or less with the rest of their team).

Arguing plus logical discussion in the teams led to

explicit knowledge creation at generic subjective level and feedback.

The virtual teams tended to have their interactions automatically logged and recorded {although not minuted}. The real team tended to minute meetings.

Subjective assessment suggests that both the real teams performed better than the three Virtual Teams.

Intersubjective and generic subjective levels appeared to have been achieved by the Virtual Teams but the real teams appeared to achieve all the subjective levels of Weick and Wiley.

Teams constructed understanding although different people had different filters and different maps of the world and the task. The real teams approached the 'oneness' of Japanese tradition. The virtual teams developed generic subjectivity by arguing, expecting, committing and manipulating.

All five teams created new communities of practice that appeared to function after teams had completed their tasks.

The real teams appeared to be more forgiving of members that did not complete work on time than the virtual teams.

The virtual groups sent a lot of E-mails about the tasks (more than two per day per person) but in a lot of cases this appeared to be noise rather than communication.

The virtual teams felt that limited time hindered progress although the real teams did not feel this, despite having the same tasks, deadlines and time-scales.

The virtual teams had extra transaction costs and costs of training and adaption.

The virtual groups took longer to form and norm and throughout the tasks, sub-groups of the virtual teams were at different stages.

The virtual teams tended to assign tasks and then wait until deadlines passed before realising that some team members had not completed work.

When team members were felt by others to have failed to perform to satisfactory standards then they were sometimes not trusted again.

In some cases team members did not want to share their work with other members.

An advantage of working in the virtual teams was that

expertise became available without the usual costs of travel and arrangement costs across different countries.

An initial face-to-face meeting was felt helpful for all of the groups. At their first meeting the teams used explicit team building process and this appeared to be useful in building the virtual teams later. It appeared to help if the teams had met socially before the tasks in order to start getting to know each other early. If this was not possible then team members felt that photographs and CVs may help.

All the teams considered and observed themselves moving through Tuckman's Forming, Storming, Norming & Performing although the virtual teams found this process more complex and difficult than the real teams.

The virtual teams felt that it was difficult to create a sense of urgency and synergy (even when one actually existed).

Virtual team members felt that they should have tried to know more about each other and could have extracted more information about each other.

Once knowledge about each other was gained then virtual teams attempted to use the advantages, skills and knowledge of individuals and the team.

Agendas assist discussion and provide much needed structure for virtual (Lyceum) meetings and synchronous discussions.

The virtual teams appeared to be less willing to trade knowledge within their own teams and between teams.

The virtual teams appeared to spend too much time reflecting and not enough time doing (real teams appeared to spend all the time doing with little reflection).

The virtual teams felt that they needed to include extra procedures and rules for communication and some effort was expended in this way.

First Class was popular and provided valuable thinking time between communications and tended to involve the whole team, sometimes for semi-synchronous chat. The history function was well used. The system preserved messages.

Pen and paper was seen as reliable and familiar and was popular with older members that used pen and paper a lot; they liked the feel of the paper and of writing. Like First Class, messages were preserved but were private and separate.

E-mail was familiar to most of the group and required little training. E-mail reached much further than First Class but still provided the valuable thinking time and often involved the whole team. Feedback was slow but messages were given a higher status.

The telephone was highly trusted but not used much, except for urgent communication although some members did not provide a contact telephone number and although the medium lacked visual feedback it did include intonation and volume. Communication was sometimes regarded as lower status.

Post was slow and often only used as a last resort. Feedback was slow and messages were considered to have a lower status.

Face-to-face meetings were popular and very familiar and often led to a more relaxed discussion although virtual teams found it difficult to arrange face-to-face meetings and some never managed to get everyone together at the same time. All the senses were affected and messages were felt to have a higher status.

Virtual team members that did not communicate face-to-face were jealous of meetings between other members of the team.

Radio Cassettes were familiar but not popular.

Lyceum was difficult to use effectively and needed a substantial run in and training time. Communication needed extra organisation and preparation. Pauses and delays occurred with misunderstandings and silence. Feedback needed to be more explicit than usual. Two virtual teams did not manage to get everyone together at the same time. Communication was fraught with technical difficulties and included many costs, including financial costs for hardware. The style of media has potential and is expected to become more popular once technical difficulties have been sorted out.

Individual WWW sites were effective for sharing and making knowledge re-usable.

Virtual teams tended to assign individual work and then to report back. Real teams tended to work more in sub groups.

Weick(1979) Enactment / Selection / Retention appeared to operate for the virtual teams within an iterative triangle.

Virtual Groups working to tight schedules left different sub-groups at different places in Forming, Storming, Norming, and Performing.

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