

Can the Performance of Virtual Teams be Improved? An Empirical Study

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Abstract

This paper compares the processes of Face-To-Face (FTF) and Virtual Teams (VT) and proposes methods to improve the performance of virtual teams. The discourse of fifteen FTF and fifteen VT teams were analysed. Their discourses were coded by the TEMPO system developed by Futoran et al. (1989) and the communication pattern of each team was drawn. Four approaches to improve the performance of VT are proposed: (1) Posting well-organised information; (2) Increasing “process gain” activities and decreasing “process loss” activities; (3) Instructions and facilitation to promote the discussion of process and content equally and facilitate better communication patterns; (4) Minimising members’ absences.

Keywords: virtual teams, performance, FTF vs. VT, TEMPO system

1. Background Introduction

Although studies on the comparison of performance in VT and traditional FTF teams show a variety of findings, generally the performance of VT does not outperform traditional FTF teams. For example, Warkentin et al. (1997) studied VT versus FTF teams in a web-based conference system and found that the performance and satisfaction of virtual teams was lower than FTF teams. It is not easy to establish intimacy and bonding among the VT members and so, the decision-making quality and satisfaction of VT is lower than in traditional FTF teams (Valacich & Sarker, 2002; Warkentin et al., 1997; Galegher & Kraut, 1994; Straus, 1997). Most studies in comparison of FTF and VT focus on quantitative methods (questionnaire), such as Straus (1997), Benbunan-Fich et al. (2001) and Valacich et al. (2002). There is little research using qualitative methods to compare both despite scholars urging for more qualitative research in the IS field (Chen et al., 2004; Espinosa et al., 2006; Nandhakumar and Baskerville, 2006). Accordingly, this study adopted a qualitative approach to compare both teams and propose the methods to improve the performance of VT.

2. Research Methodology

“Information Systems I” is a foundation unit for business undergraduate students and the case study, which was a group writing assignment, is an integral part of the course

and designed by the researchers to proceed over four weeks. Students were grouped with four people randomly and had to cooperate to answer a series of questions and hand in a final report before the deadline. This study lasted over two semesters. For the FTF part of the study, in semester one, 45 groups were assigned randomly and students gathered in the assigned discussion rooms with tape recorders and were required to record their conversations and then return the tapes to the researchers. This lasted for three weeks. The fourth week was for students to finalise the assignments and submit. In the VT setting, in semester two, 55 groups with members pre-assigned (all from different lecture groups) were allocated. Discussion boards, built in a Networked Learning Environment Courseware System called Blackboard, were created for each group. Students could login in and enter their group discussion board to discuss and exchange files to finish the assignments over four weeks. After marking the assignments, fifteen groups were selected by their grades and their discourses (FTF: tape; VT: discussion board) were analysed: five groups in excellent performance; five groups in moderate performance; and five groups in poor performance from each semester.

The TEMPO coding system by Futoran et al. (1989) was used to code the discourses of FTF and VT. The TEMPO system uses two categories: production function categories and non-production function categories. The former includes four main categories that represent group performance: “Propose content” contributes to the task content; “Propose process” contributes to group process; “Evaluate content” contributes to the monitoring and evaluation of task content; and “Evaluate process” contributes to the monitoring and evaluation of group processes. The latter reflects the activities that involve personal or interpersonal content. Using categorisations from Powell et al (2004), production function categories were regarded as **task dimensions** while non-production function categories were regarded as **social dimensions** in this study. To draw the communication patterns, a code and number were assigned to each category as shown in Appendix 1. The code (pp1, pp2...) is used in Nvivo to code the discourses. The coding rules are based on the purposes of the discourse. The researchers coded independently and the Cohen’s Kappa statistic between the researchers is 0.74. This is well above the 61% level suggested by Fleiss (1981).

3. Data analysis

● Comparing the assignments of FTF and VT

From the student grades it was found that the average grade of VT was lower than FTF. Additionally, the structure of VT assignments was more loosely coupled and there was a higher ratio of inconsistency between the results and arguments in all the

questions.

- **Summary of Discourse of FTF groups**

Appendix 2 shows the summary of the discourse of fifteen FTF groups (ranked by performance). From Appendix 2, it can be summarised as below:

(1) Longer discussion time and more information exchange affect the performance positively

From the two columns: time and codes, the excellent and moderate performance groups had slightly longer discussion time and exchanged more information than the poor performance groups.

(2) FTF groups focused on content more than process

From the two columns: p_total and c_total, the latter is higher than the former and accounts for 50% of the codes. FTF groups focused more on content than process discussion.

(3) The amount of social activities does not reflect the degree of performance

By observing the column: np_sub, group 9 had the highest proportion of social activities (43%) but just had a moderate performance. Group 11 had the second highest percentage of social activities (40%) but was placed in the poor performance group. However, group 3 with an excellent performance had the lowest proportion of social activities.

- **The Communication Pattern of FTF**

The communication patterns of fifteen FTF groups were drawn by the TEMPO system and Figure 1 shows an example from FTF group 3. X-axis stands for time (three-week recordings) and Y-axis shows the codes from 1 to 20. Each point represents the group's focus during a short time. For example, this group focused on a "process propose" activity at the beginning, then moved to a "process evaluate" activity.

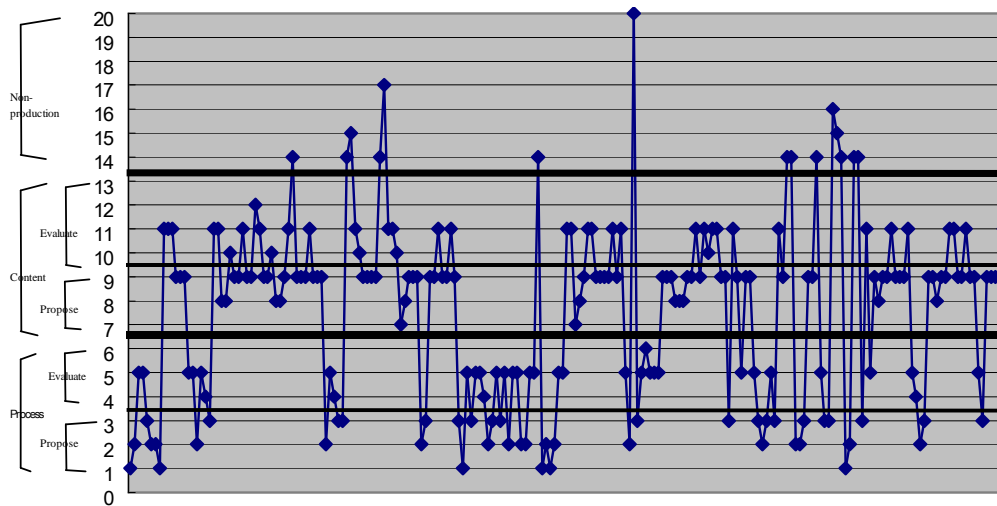


Figure 1 A communication pattern example of FTF group 3

By analysing the communication patterns of fifteen FTF teams, some conclusions are listed:

- (1) There is no fixed successive discussion pattern but well-organised communication could lead to better performance
- (2) More “process gain” activities led to higher performance
- (3) Social loafing (Free rider) accounts for the biggest proportion of the “process loss” behaviours affecting the performance.

● Summary of The Discourse of VT

Appendix 3 shows the summary of the postings of VT (ranked by performance). From Appendix 3, it can be concluded:

- (1) The groups with more discussion had better performance
Comparing the postings of the three groups it can be seen that the groups with excellent and moderate performance had more postings than the groups with poor performance.
- (2) Groups that focused on “process” and “content” equally, had better performance
By observing the two columns “p_total” and “c_total”, it can be seen that the groups focusing on both process and content equally had better performance. In the poor performance groups, they paid more attention to process instead of content.
- (3) Non-production activities (social activities) accounted for a smaller proportion of time when compared with FTF groups
Non-production codes (“np_sub” column) just accounted for 10~20 percentage for each group showing that VT groups focused more on task activities.

● The Communication Pattern of VT

Figure 2 shows an example from VT group 1. X-axis stands for time (four-week discussion) and Y-axis shows the codes from 1 to 20. Each point represents a main intention of postings. For example, the members focused on “Non-production” activity at the beginning, then moved to a “Process-propose” activity.

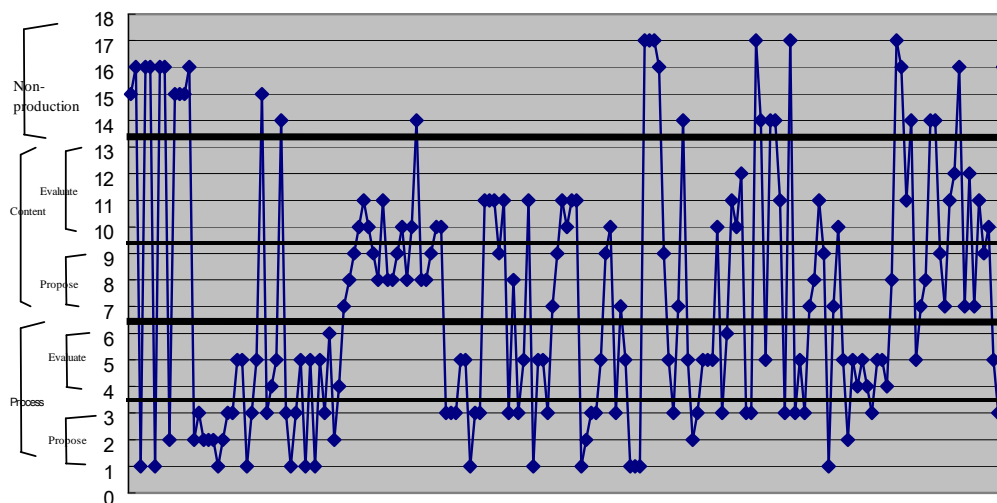


Figure 2 Communication pattern of VT group 1

By analysing the communication patterns of fifteen VT teams, some conclusions are drawn:

- (1) Best communication pattern is process → content → process → content

This pattern can be observed in groups with better or moderate performance. On the contrary, groups with poor performance did not display this pattern. This pattern is similar to the Punctuated Equilibrium Model (Gersick, 1988) as shown in Figure 3.

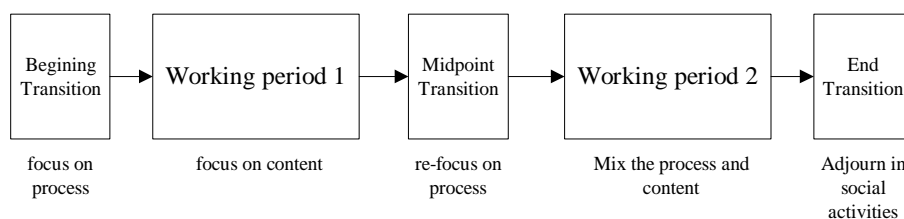


Figure 3 A better communication pattern for VT combined the Punctuated Equilibrium Model

- (2) “Interlaced communication” diminished the efficiency of communication

“Interlace communication” occurred due to the responders replied in an interval of two or more than two postings instead of responding to the next posting. A discussion topic was usually terminated inexplicably instead of fully discussed (became “broken end”).

- (3) The more “process gain” activities the group had, the higher the performance

4. Methods to Improve the Performance of VT

The researchers suggest the following methods to improve the performance of VT:

- (1) Posting well-organised information

Although the speed and flow of information exchanged in VT groups is slow, well-organised and rich-content postings can overcome the defects in communication. When VT members posted to the discussion board, it was found that the postings were better arranged than in face-to-face conversation. In addition, the properties of the postings on the discussion board can be easily searched and read repeatedly facilitating discussion and information exchange.

To ensure well-organised postings, training is required on how to use the systems and how to post effectively. In a study by Warkentin and Beranek (1999), participants were introduced to a bulletin board system “MeetingWeb” to learn the skills to communicate by “posting” messages in a hierarchical manner (threaded discussion). They were also introduced to “rules of netiquette” and given examples of abbreviation to assist in effective communication and to avoid misunderstanding and misinterpretations. For example, “BTW” means by the way; “FEIW” represents for what it is worth. They are also instructed not to type comments which may be misinterpreted as inflammation. This is supported by a study by Tan et al. (2000).

- (2) Increasing “process gain” activities and decreasing “process loss” activities

Providing instructions and guidance to facilitate the “process gain” activities, such as encouraging the members to post, fast response to others’ ideas and to be willing to help others. “Interlaced communication” causes “process loss” and training members to use the discussion board effectively could be the best method to solve this problem. Another issue which causes “process loss” is social loafing. It is perhaps unavoidable that some members are content to be “free riders” but this behaviour also affects and demotivates other members in the VT group. Asking the members to sign a group contract in order to increase the sense of honour and responsibility could be a way to solve the issue. In addition, Dineen (2005) found that social loafing is lower in fluid teams than in stable teams due to the members tend to be on “better behaviour” and more inhibited in the presence of strangers. Thus, a mechanism to rotate team

members across different projects could keep the teams fluid and reduce social loafing.

(3) Instructions and facilitation to promote the discussion of process and content equally and facilitate better communication patterns

The discussion of process and content are important equally and the most effective communication pattern is process → content → process → content". The solution is to provide clear instructions before the start and align with the instructors (Swan, 2001; Casper-Curtis, 2002) to guide members to form structured communication patterns.

Rourke et al. (2001) explained that there are three forms of interaction in an on-line learning environment: interaction with content, with instructors and with classmates. Among them, interaction with instructors has been validated to positively relate to students' learning outcomes (Picciano, 1998; Swan, 2001). It stands to reason that the relationships between instructors and VT members are inclined towards task guidance. Hiltz (1994) asserts that instructors in virtual environments have three duties: cognition, affection and management. From the researchers' observations, management is the crucial function for instructors. Managing virtual teams includes the set of the goals, the preparation of documents, the confirmation of each member's situation, management of time and techniques and the guidance of the processes (Alexander, 2002).

(4) Minimising members' absences

Members' absence from the group discussion affected the performance severely, not only reducing morale but also inhibiting collaboration and leading to worse or incomplete outcomes. One solution to the problem is to ask members to sign a group contract increasing the sense of obligation and responsibility. Another solution relates to difficulty in coordination of members' schedules. While it is hard to control the length of members' missing time, it could be solved according to a collaboration model proposed by Qureshi et al. (2006) shown in Figure 4.

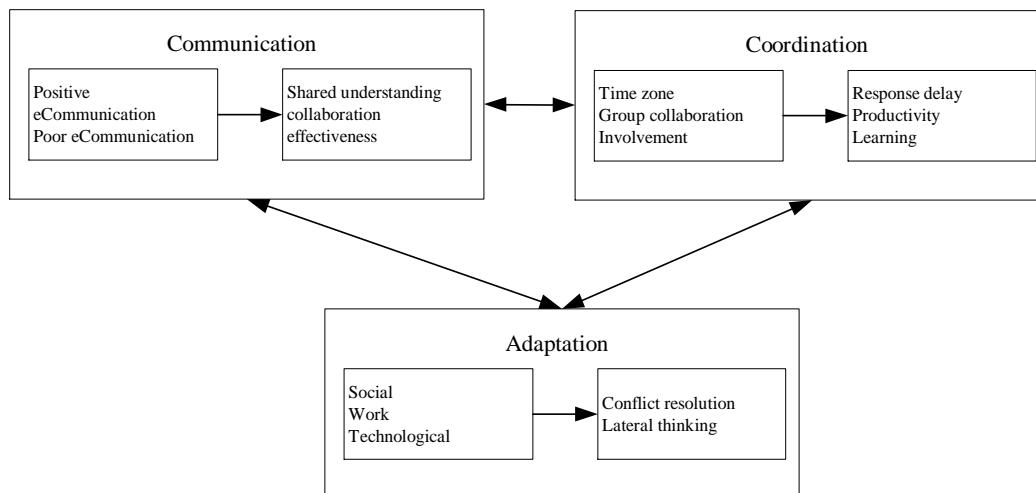


Figure 4 Model of collaboration (From Qureshi et al., 2006)

This model suggests that collaboration of VT members is improved by exchanging information on each member's schedule. Sharing project schedules and task related information can help VT members to conquer their individual adaptation problems and reduce conflicts. For example, if a member knows the time to leave for a business trip, he could inform other members in advance. Other members can change their schedules to fit the change or even take over his jobs. This reduces the influence of member's leaving.

5. Conclusion

Finally, although the environment of this study is an education setting, it is believed that the proposed approaches are not only applicable to on-line learning but also beneficial to business practice. Most on-line learning courses are based on discussion boards, and instructors can refer to the proposed approaches to improve the students' performance of the group assignments. In the business practice, these proposed approaches provide views for project managers to design the composition of VT, resolve conflicts and obtain a better performance.

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Appendices

Appendix 1 TEMPO Coding System (arranged from Futoran et. al. (1989, p. 219)

Production Function Categories

Item	Code	Number	Item	Code	Number
Content			Process		
Propose					
New-task content	cp1	7	Goals	pp1	1
Prior	cp2	8	Strategies	pp2	2
Dictate	cp3	9	Acts	pp3	3
Evaluate					
Agree with/accept	ce1	10	Agree with/accept	pe1	4
Clarify/modify	ce2	11	Clarify/modify	pe2	5
Disagree	ce3	12	Disagree	pe3	6
Reject/Veto	ce4	13			

Non-production Function Categories

Task digression	npt	14	React to experiment	npr	17
Personal comments	npp	15	Digressions	npd	18
Interpersonal	npi	16	Uninterpretable	npu	19

comments

Appendix 2 The summary of the frequency distribution and percentage of the discourse of FTF groups

Group	Per	Time (min)	Code s	Code s/Time	pp_sub	pe_sub	p_total	cp_sub	ce_sub	c_total	np_sub
1	Exc	105	131	1.25	34(26%)	22(17%)	56(43%)	42(32%)	21(16%)	63(48%)	12(9%)
2	Exc	65	71	1.09	14(20%)	10(14%)	24(34%)	13(18%)	16(23%)	29(41%)	18(25%)
3	Exc	125	211	1.68	44(21%)	34(16%)	78(37%)	79(37%)	39(18%)	118(56%)	15(7%)
4	Exc	70	147	2.1	13(9%)	23(16%)	36(24%)	33(22%)	35(24%)	68(46%)	43(29%)

)				%)		%)
5	Exc	80	137	1.71	24(18%)	26(19%)	50(36%)	32(23%)	35(26%)	67(49%)	20(15%)
Sub/Average		89	139.4	1.57	129(19%)	115(16%)	244(35%)	199(29%)	146(21%)	345(49%)	108(15%)
6	Mod	100	155	1.55	18(12%)	17(11%)	35(23%)	44(28%)	39(25%)	83(54%)	37(24%)
7	Mod	72	102	1.42	17(17%)	6(6%)	23(23%)	21(21%)	14(14%)	35(34%)	44(43%)
8	Mod	75	133	1.77	17(13%)	13(10%)	30(23%)	47(35%)	45(34%)	92(69%)	11(8%)
9	Mod	77	178	2.31	24(13%)	29(16%)	53(30%)	41(23%)	31(17%)	72(40%)	53(30%)
10	Mod	115	103	0.89	15(15%)	71(11%)	162(24%)	48(47%)	12(12%)	60(58%)	22(21%)
Sub/Average		87.8	134.2	1.59	91(14%)	71(11%)	162(24%)	201(30%)	141(21%)	342(51%)	167(25%)
11	Poor	110	206	1.87	35(17%)	23(11%)	58(28%)	73(35%)	35(17%)	108(52%)	40(19%)
12	Poor	67	105	1.57	20(19%)	20(19%)	40(38%)	25(24%)	17(16%)	42(40%)	23(22%)
13	Poor	65	131	2.01	17(13%)	23(18%)	40(31%)	49(37%)	25(19%)	74(56%)	17(13%)
14	Poor	75	81	1.08	22(27%)	19(23%)	41(51%)	16(20%)	9(11%)	25(31%)	15(19%)
15	Poor	75	104	1.39	18(17%)	16(15%)	34(33%)	33(32%)	12(12%)	45(43%)	25(24%)
Sub/Average		78.4	125.4	1.58	112(18%)	101(16%)	213(34%)	196(31%)	98(16%)	294(47%)	120(19%)

Per: Performance (excellent/moderate/poor), codes/time: how many codes per minute, pp_sub: sub-total of Process-Propose, pe_sub: sub-total of Process-Evaluate, p_total: total of Process, cp_sub: sub-total of Content-Propose, ce_sub: sub-total of Content-Evaluate, c_total: total of Content, np_sub: Non-production categories

Appendix 3 The summary of the frequency distribution and percentage of the postings of VT

group	per	posts	codes	codes/	pp_sub	pe_sub	p_total	cp_sub	ce_sub	c_total	np_sub
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				posts							
1	Exc	172	181	1.05	53(29%)	35(19%)	88(49%)	32(18%)	31(17%)	63(35%)	30(17%)
2	Exc	103	155	1.50	36(23%)	25(16%)	61(39%)	46(30%)	34(22%)	80(52%)	14(9%)
3	Exc	77	84	1.09	26(31%)	16(19%)	42(50%)	26(31%)	10(12%)	36(43%)	6(7%)
4	Exc	72	101	1.40	24(24%)	13(13%)	37(37%)	26(26%)	26(26%)	52(51%)	12(12%)
5	Exc	58	63	1.09	14(22%)	10(16%)	24(38%)	14(22%)	19(30%)	33(52%)	6(10%)
Sub/Average		96.4	116.8	1.23	153(26%)	99(17%)	252(43%)	144(25%)	120(21%)	264(45%)	68(12%)
6	Mod	213	241	1.13	34(14%)	27(11%)	61(25%)	85(35%)	90(37%)	175(73%)	5(2%)
7	Mod	114	148	1.30	28(19%)	32(22%)	60(41%)	24(16%)	24(16%)	48(32%)	40(27%)
8	Mod	114	141	1.24	41(29%)	30(21%)	71(50%)	23(16%)	24(17%)	47(33%)	23(16%)
9	Mod	112	113	1.01	32(28%)	26(23%)	58(51%)	23(20%)	21(19%)	44(39%)	11(10%)
10	Mod	75	105	1.40	157(21%)	142(19%)	299(40%)	172(23%)	177(24%)	349(47%)	100(13%)
Sub/Average		125.6	149.6	1.22	22(21%)	27(26%)	49(47%)	17(16%)	18(17%)	35(33%)	21(20%)
11	Poor	71	89	1.25	23(26%)	17(19%)	40(45%)	18(20%)	27(30%)	45(51%)	4(4%)
12	Poor	62	81	1.31	34(42%)	20(25%)	54(67%)	7(9%)	9(11%)	16(20%)	11(14%)
13	Poor	46	59	1.28	21(36%)	19(32%)	40(68%)	5(8%)	9(15%)	14(24%)	5(8%)
14	Poor	34	45	1.32	19(42%)	10(22%)	29(64%)	4(9%)	5(11%)	9(20%)	7(16%)
15	Poor	25	34	1.36	7(21%)	8(24%)	15(44%)	11(32%)	6(18%)	17(50%)	2(6%)
Sub/Average		47.6	61.6	1.31	47(34%)	37(27%)	84(61%)	20(14%)	20(14%)	40(29%)	14(10%)

Per: Performance (excellent/moderate/poor), pp_sub: sub-total of Process-Propose, pe_sub: sub-total of Process-Evaluate, p_total: total of Process, cp_sub: sub-total of Content-Propose, ce_sub: sub-total of Content-Evaluate, c_total: total of Content, np_sub: Non-production categories