

# THE HKNET PROJECT: E-COLLABORATION AND VIRTUAL TEAM IDENTITY

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## Abstract

*E-collaboration is much more than the technological equivalent or substitute for traditional face-to-face collaboration. The new metrics of time and distance modify, in essence, human interactions and, indeed, turn the classic network of face-to-face relationships into a network of e-relationships between individuals. The network, in turn, influences the development of a virtual team and its process and product. During the past four years, the authors have developed an educational project involving hundreds of students from different national cultures working together for six weeks on a specific project (HKNet). In this paper, we present our experiences and draw conclusions giving special attention to relevant social processes such as the development of multi-cultural team identity.*

*Keywords: virtual teams, culture, ICT, social identity theory.*

## **1 INTRODUCTION**

Societies have evolved to encompass new forms of interaction and collaboration with the development of new technologies, and particularly Information and Communication Technologies (ICTs). The World Wide Web (WWW) allows individuals access to e-groups of customers seeking the best product and enables virtual teams to work together and remotely on a project. The interest business shows in e-collaboration is particularly oriented towards virtual meetings. Indeed, apart from the financial benefits involved in cutting travel costs and saving time, the main advantage of virtual meetings is that their format is familiar to participants, who are used to traditional face-to-face meetings. Another advantage is the possibilities provided to the participants to faster get to know one another and build their virtual team identity important for team spirit. Therefore the idea of virtual meetings is implicitly understood. For this reason, virtual meetings, and similarly e-collaboration, are guilelessly likened to face-to-face meetings supported by electronic devices such as videoconference. However, the influence of ICTs on human interactions generates a much more complex reality and impact processes of the virtual team at multiple level.

During four years, the authors developed an educational project called HKNet (Hong Kong-Netherlands) involving 268 students from different national cultures working together for six weeks on a specific IT project. The four years of experience revealed the complexity of e-collaboration and the need to shape the interaction to avoid chaos and failure in virtual teams. Once the basic technical barriers have been removed, the main issues to deal with are organisational and social. For example, national and/or professional cultural divergences enter into balancing the structure of the group i.e., power repartition and its size. Motivation and respect for cultural diversity i.e., balance pooling and social comparison within and between the groups are special issues. The team members' characteristics are additional elements of consideration for the success of the virtual teams. Discipline and assertiveness, a high level of engagement and reciprocity with the other participants all enter into efficient decision-making and e-collaboration (Vogel et al 2001, Rutkowski et al 2001).

This paper demonstrates that experiencing virtual team spirit and identity without meeting physically person-to-person is a reality. However, e-collaboration is much more than the technological equivalent or substitute for traditional face-to-face collaboration. Indeed, selecting the appropriate sets of ICTs, structuring the group processes, building trust and supporting decision-making are subtle activities that go far beyond sitting in front of a screen and telling him "ok, you can talk now". Section 2 of the paper presents three research hypotheses that have been built on a socio-constructivist theoretical background. Section 3 presents in detail the set-up of the HKNet project and the experimental design. Before concluding with lessons learned during the fourth years of the project, section 4 presents and discusses some selected results gathered during the fourth year of the project.

## **2 CULTURAL ASPECTS AND INTERGROUP BEHAVIOR**

Culture plays an especially salient role in virtual teams. Culture is a system of knowledge, a set of learned behaviour and beliefs, a way to categorise experience (Triandis, 1994) shared by a particular society, population, or group of individuals. A popular way to look at culture involves the examination of personality traits. From this perspective, culture is seen as a relatively stable and long lasting attribute of our behavior. Numerous cross-cultural researchers (e.g., Gudykunst et al., 1988) have used cultural dimension models developed by Hofstede (1983) to distinguish members of one cultural group from another. While Hofstede's cultural model has often been criticized for containing sampling flaws (all 116,000 respondents across 53 countries were of a single large corporation, IBM), the general cultural constructs or dimensions have been shown to be useful for explaining potential differences in culture with regard for example to the use of IT (e.g., Mejias et al., 1997).

The three cultures involved in the HKNet project were the French, Dutch and Hong Kong. As shown in Table 1., the three cultures scored differently on the four dimensions of Power Distance (high versus low), Uncertainty Avoidance (high versus low), Individualism (versus Collectivism), and Masculinity (versus Femininity).

		Power Distance	Uncertainty Avoidance	Masculinity	Individualism
Hong Kong	Index	68	29	57	25
	Rank	37-38	4-5	32-33	16
France	Index	68	86	43	71
	Rank	37-38	36-41	17-18	40-41
Netherlands	Index	38	53	14	80
	Rank	14	18	3	46-47

\*Rank Number: 1= Lowest; 50= Highest.

Table 1. *Hong Kong, France and Netherlands index and rankings on Hofstede's four dimensions of culture (Hofstede 1983).*

Traditionally, the Asiatic culture places emphasis on the position of the individual *within* the group, while the Dutch culture stresses the position of the individual *towards the group* in terms of structural position. In Asia, the rules of "guanxi" i.e., a network of personal relationships or of interpersonal connections regulating social interaction (Hwang, 1987) structure the society. The leader is expected to take control and be in possession of solutions that will be offered to the group. In a congruent way, the collectivist dimension is linked to a system of high power distance in the culture in Hong Kong (cf Table1). On the contrary, Westerners and particularly the Dutch society evolved around a lower power distance structure where a democratic style of leadership is more typical in the process of seeking consensus and taking decisions.

The dimension of Individualism/Western versus Collectivism/Confucian dichotomy has proven to have an effect on the social labouring and loafing in the group. For example, in a brainstorming task, Harkins & Szymanski (1989) demonstrate that the group performance can be increased when the results are not pooled and the participants know that their personal output is monitored. In other words, in the Western world, to increase group productivity and decrease social loafing, it can be useful to make people's contribution to the group task more identifiable (Williams et al., 1981). Competition between groups can also boost productivity (Earley, 1993). Guanxi rules also apply to group productivity and imply a more co-operative attitude from Eastern members to their fellow group members, i.e., family, village, workplace (Triandis, 1994).

Culture has often being study as a static phenomenon (see Myers and Tan, 2002). However, we share the idea that culture should be understood as a socially constructed and dynamic process that supports the emergence of multiple cultures. It is the product of interaction amongst different cultural groups (Straub et al., 2002). The dynamic aspect of culture relies, for a large part, on the social abilities of individuals to change their patterns of thinking and acting when interacting with persons or groups that share different systems of knowledge.

Tajfel's Theory of Social Identity (SIT) and intergroup behavior postulate that a group exists when two or more individuals perceive themselves to be members of the same social category and when its existence is recognised within the social environment by at least one other (Tajfel, 1981). In the framework of the HKNET project, the notion of social environment refers to the natural existence of three cultural ingroups, sharing different belief systems, that are organized via virtual medium in multi-cultural teams. In such a virtual environment, the construction of the multi-cultural group will require each of the cultural ingroups to develop knowledge and social understanding of the other

outgroup in order to build a superordinate group identity having its own norms and values (Sherif, 1969).

The aim of the paper is not to test the effect of national culture in a stereotypical way, e.g., seeking for differences/similarities amongst the ingroups but to investigate on their dynamic and socially constructed nature. This paper proposed to investigate how participants sharing the same virtual experience but belonging to different cultural system of knowledge could develop a group identity and join consensus to make efficient decision necessary to support team spirit. Particularly, will it be more difficult for the participants to develop shared norms and build a social identity when more cultures are involved in the virtual team.

Three hypothesis have been developed:

H1: Interactive national teams (ingroup) will change their normative cultural need for hierarchical structure and will converge toward a Multicultural Virtual Team norm.

H2: Normative cultural need for hierarchical structure will emerge differently in a bi-cultural condition (Low social diversity) and in a tri-cultural dimension (High social diversity).

H3: Interactive national teams (ingroup) will change their pre-existing patterns of interpersonal compatibility toward a superordinate Virtual team Identity.

To gather data to support or refute these propositions we organized graduate students from four universities into nominally eight person teams and engaged them in a six-week project in the spirit of action research covering phases of divergence and convergence resulting in an integrated deliverable.

### **3 THE HKNET PROJECT: FOUR YEARS OF MULTICULTURAL E-COLLABORATION**

The majority of GSS research has been conducted with groups in a laboratory context at the same time and same place. Studies conducted in educational contexts with the support of GSS at the asynchronous level and in the real world are relatively rare (Alavi et al., 1997; Qureshi and Vogel 2001). The classical literature on virtual collaboration provides a principally transversal observation resulting from a single year experiment (Jarvenpaa & Leidner, 1998; Turoff & Hiltz, 2000). This four-year project provides a unique longitudinal observation on multi-cultural e-collaboration.

Since 1998 an educational project (HKNet) between the City University of Hong Kong (China), the Eindhoven University of Technology (The Netherlands) and Tilburg University (The Netherlands) shows that remote collaboration can lead to successful decision-making and problem-solving in multicultural groups (Vogel et al., 2001; Rutkowski et al., 2001). The HKNet project is an example of a win-win e-collaboration between students from different cultures. For the past four years, 268 students participated in this educational project. The last year of the project (HKNet-4) a team of French students joined the project from l'Ecole Supérieure d'Administration de Grenoble (France). Eighty-eight participants joined the HKNET-4 project. A characteristic of the HKNET project is to be a longitudinal study. Each new project, theoretical corpus, research problems and measurement tools were adapted according to the results of the previous project. For this reason, the set-up and results presented in this section concerned the last year of the project (HKNET-4) but built intrinsically on the observation gathered in the previous years of the project.

#### **3.1 The HKNet Project Set-up**

The HKNet project consisted of existing academic courses in software engineering, informatics and management (MBA). The goal of the project was to make a valuable contribution to the knowledge of its participants by letting teams collaborate on a joint project on a specific IT-related subject resulting in a joint report. Students formed their own local team consisting of three to five team members.

Thereafter, local teams were allocated to global teams, each with a specific assignment. Examples of assignments were: software management in large projects, trends in embedded software, software quality control, labour shortages in the IT sector and critical success factors for successful development of software.

By communicating with their overseas team members through group support technologies, the students also gained experience in using these technologies and the team dynamics within these multicultural teams. Participants used e-mail, videoconferencing and blackboard learning platform technologies to communicate synchronously and asynchronously. The time schedule was rigorous and short (six weeks). In HKNet-4, the students were free to converge after a week when they felt ready to use blackboard technology. The task of the participants was to create a joint report comprised of a general introduction on the subject and a description of the situation in each country (Hong Kong/Asia, Netherlands/Europe, France/Europe).

The HKNet-4 project introduced a new challenge for the participants necessitating a higher level of co-ordination and technological ability. The virtual teams were asked to develop an e-report in the form of a web portal. The educational objectives of the HKNet projects were to give students (i) an insight into software engineering, informatics and managerial issues from a business perspective and increase the understanding of the differences and similarities between Europe and Asia; (ii) experience co-operating in a team with members from different cultures and backgrounds; and (iii) familiarise them with several applications of groupware, which can be valuable to their study and (future) work. The participants were asked to fill in two questionnaires: a pre-test prior and a post-test posterior to the e-collaboration in order to gather their opinion and measure their attitude change through the HKNet project (Himmelfarb and Eagly, 1974).

### 3.2 ICT Support

*ISDN videoconferencing* was used to initiate the project as well as halfway through and in a concluding session. *Blackboard 5.5.1* technologies supported the virtual team interaction. Blackboard is a course delivery system with group support capabilities that enables groups to enter information simultaneously, synchronously or asynchronously in a structured manner, using a variety of specially designed tools (e.g., group discussion board, group virtual classroom, file exchange, e-mail). All participants additionally had personal *e-mail* accounts at their disposal.

### 3.3 Experimental design (HKNet-4)

The 104 participants were graduate students from four universities involved the HKNet-4 project. They were part-time Masters of Science in Electronic Commerce (MScEC) students from Hong Kong, full-time industrial engineering students from Eindhoven (The Netherlands), full-time MIS students from Tilburg University (The Netherlands) and full-time MBA students from l'Ecole Superieure d'Administration de Grenoble (France). The 104 participants were spread across 13 teams, eight of them tri-cultural (n=66) with the remaining five bi-cultural (n=38). Local teams of participants were self-selected. Local teams chose a topic from a prescribed list. The multicultural virtual teams were formed based on the chosen topic before the cultural counterparts had met. The average age of the participants was 25 years. 12.5 percent were female. All Hong Kong participants had at least one-year full time working experience while only 25% of the French and 15% of the Dutch participants had at least one-year working experience. The large majority of the participants had personal experience or social link with foreigner people (81.5%). The Hong Kong participants happened to be more experienced (88.2%) than the Dutch (78.4%) or the French (76.2%). They all felt the same wish to collaborate with participants from different national cultures ( $\bar{m}=7.23, \underline{SD}=1.57$ ). Only 17.6% of them had previous experience working in a multicultural team. The more experienced in that matter were the Dutch (24.3%), then the Hong Kong participants (15.15%) and last the French (9.5%). The participants had to take part in the HKNet to pass the exam for the class at their respective universities.

## 4 RESULTS AND DISCUSSION

The computation of the Pre-test/post-test reliability over a 6-week period indicated a Cronbach's alpha of .698. Cronbach's (1951), numerical coefficient of reliability, is based on the reliability of a test relative to other tests with same number of items (k), and measuring the same construct of interest. Second, in order to validate each of the instruments of measure, we used Cronbach's (1951) alpha coefficient as an index of internal consistency. The computation of the coefficients range from 0.856 to 0.664, exceeding the threshold of 0.60 given by Nunnally (1967) as being acceptable reliability for research purposes and indicated a correct internal consistency reliabilities of the constructs. A total of 177 questionnaires were filled in (pre-test=82 and post-test=95). The tests of the assumptions of homoscedasticity of variances and normality were satisfactory and supported the choice to run parametrical statistical tests at the multivariate level. Concerning the measure of attitude change, we performed our analyses at the individual level in order to measure the effect of the virtual collaboration on the attitude change of each participant (Himmelfarb and Eagly, 1974).

The MANOVA (Multiple ANalysis of VARIance) conducted on the pre-test questionnaire revealed a significant Culture main effect on the pre-test (Wilks' Lambda=.118,  $p < .0001$ ) The size of each sample per culture did not allow running any factorial analysis per principal component. Analysis of Variance and student-t comparisons were chosen as the most efficient statistical tests to run on the data. The MANOVA conducted on the post-test questionnaire revealed a significant Culture main effect (Wilks' Lambda=.206,  $p < .0001$ ), a significant Cultural Diversity main effect (Wilks' lambda= $< .0003$ ) and no significant interaction effects between both factors.

Table 2. presents the results of the associated 3 (Culture: Hong Kong versus French versus Dutch) between-subjects ANOVA for the pre-test and the results of the associated 3 (Culture: Hong Kong versus French versus Dutch) \* 2 Cultural Diversity (Bi-cultural versus Tri-cultural) between-subjects ANOVA for the post-test. Of importance to the analysis, the results presented in Table 3 concerns exclusively the effect of the factor Culture for the pre-test and the post-test. Indeed, the results of the ANOVA conducted on the post-test indicated no interaction Culture\* Cultural Diversity effect and a single Cultural Diversity main effect on the dependent variable "leadership requirement". This effect will be presented in detail later in the text.

Items (k=18) Cronbach's alpha test/re-test=.689	Pre- test/ Post- test	SS	MS	F	df	p	Lambda	Power
Hierarchy	Pre*	8.654	4.327	5.485	2,84	.0058	10.971	.848
	Post	4.682	2.341	3.019	2,75	.0548	6.038	.560
Leadership	Pre*	45.285	22.643	8.869	2,84	.0003	17.737	.978
	Post	21.069	10.805	1.312	2,75	.2751	2.624	.266
Task	Pre	5.503	2.751	0.985	2,84	.3779	1.969	.208
Interdependence	Post	21.44	10.722	1.898	2,75	.1569	3.797	.370
Goal	Pre*	16.501	8.25	3.469	2,84	.0357	6.938	.630
Compatibility	Post*	23.842	11.921	3.826	2,75	.0262	7.652	.676
Compatibility NL	Pre*	45.285	39.75	14.876	2,84	<.0001	29.753	1
	Post*	84.453	42.227	9.841	2,75	.0002	19.683	.988
Compatibility FR	Pre*	122.998	61.499	26.849	2,84	<.0001	53.69	1
	Post*	117.354	58.677	13.033	2,75	<.0001	26.067	.999
Compatibility HK	Pre*	192.4	53.332	16.77	2,84	<.0001	33.55	1
	Post*	123.997	61.99	15.324	2,75	<.0001	30.648	1
Learn Socially	Pre	1.171	0.586	0.288	2,84	.75	0.576	.093
	Post*	36.137	18.068	5.379	2,75	.0066	10.757	.838
Learn Professionally	Pre	4.99	2.25	1.057	2,84	.352	2.114	.221
	Post*	45.419	22.71	7.22	2,75	.0014	14.4	.939

Table 2. *Univariate Tests of Significance Pre-test and Post-test: Factor Culture (between-subject)*

The results of the ANOVA conducted on the item “How much do (did) you like the fact that your own performance depend(ed) on your colleagues’ work and support” adapted from previous measure of task interdependence (Vegt, 1999), revealed no significant effect. The other results in Table 3 are clearly representative of patterns of attitude change between the pre-test and the post-test for the items relative to hierarchy and leadership as well as for the items relative to social and professional learning (cronbach’s alpha= .674). The paired test comparisons will be presented in the following section of the text in order to enlighten the results relative to patterns of compatibility (cronbach’s alpha=.856).

The items “Any kind of relationship had to be structured hierarchically to obtain harmony” adapted from the previous measure of Guanxi (Bond and Hwang, 1986) were assessed on a 5-point Likert-type scale (-2=Strongly Disagree, +2= Strongly Agree). The results of the ANOVA on the pre-test indicate a significant cultural main effect ( $p=.0058$ ). The Hong Kong participants have different conceptions of the link between “hierarchy and harmony” ( $m=0.15$ ,  $SD=0.92$ : Neutral/Agree) than the French ( $m=-0.38$ ,  $SD=0.92$ : Neutral/Disagree) and the Dutch ( $m=-0.58$ ,  $SD=0.86$ : Disagree). The ANOVA conducted on the same question in the post-test revealed no significant Culture main effect. Most of the participants joined a consensus and formed a multicultural virtual team norm ( $m_{HK}=0.67$ ,  $SD=0.66$ : Agree;  $m_{FR}=0.31$ ,  $SD=0.88$ : Agree;  $m_{NL}=0.04$ ,  $SD=0.94$ : Agree). The standard student-t paired-test comparison confirmed the results of the ANOVA in term of a significant attitude change between the pre-test and the post-test ( $t(81)=-4.75$ ,  $p<.0001$ ).

“How much is the presence of a leader in the group required?” (on a 10-point scale, from 1 not at all to 10 very much). The ANOVA conducted on that item in the pre-test revealed a significant Culture main effect (see Table 3.). Indeed, the French ( $m=6.421$ ,  $SD=2.143$ ), the Dutch ( $m=7.135$ ,  $SD=1.766$ ) and the Hong Kong participants ( $m=8.577$ ,  $SD=1.332$ ) answer differently to this item. The results of the ANOVA conducted on the same item in the post-test revealed no significant Culture main effect (see Table 3.). After the participation to the project the participants converged on that item ( $m_{FR}=6.63$ ,  $SD=2.306$ ;  $m_{NL}=6.027$ ,  $SD=3.096$ ;  $m_{HK}=7.19$ ,  $SD=2.89$ ). The Dutch participants ( $t(36)=2.003$ ,  $p=.05$ ) and the Hong Kong participants ( $t(25)=2.156$ ,  $p=.04$ ) changed their opinions between the pre-test and the post-test.

As we shortly described, of importance to the research, the results of the ANOVA conducted on the post-test indicated no interactive Culture\* Cultural Diversity effect and a single Cultural Diversity main effect ( $F(1,75)=6.263$ ,  $p=.0145$ .) on the dependent variable “leadership requirement”. This effect indicated that the participants did not answer differently to the questionnaires pre-test and post-test form in function of the cultural diversity of the multicultural virtual team they belong to, except for the item that characterized leadership. Indeed, the unpaired comparison test indicated clearly that the participants that belong to the bi-cultural multicultural virtual team ( $m=5.563$ ,  $SD=2.994$ ) considered the presence of a leader significantly ( $t(93)=-2.073$ ,  $p=.0409$ ) less required than the participants that belong to the tri-cultural virtual teams ( $m=6.857$ ,  $SD=2.816$ ).

From a descriptive perspective, the answers of the participants to the items relative to the “emergent style of leadership” indicated that the low social diversity multicultural virtual teams (condition bi-cultural) applied indifferently a leadership oriented toward the task (51%), rotative leadership (43%) or declared that no particular participants/teams took the lead (30%). In the condition tri-cultural, 68% of the participants declared that the leadership was oriented toward the task and the time schedule, 39% declared that each team had his own national team leader and 30% had the feeling that no particular participants/teams took the lead. The answer to the item relative to the “type of emergent conflict” congruently indicate that bi-cultural virtual teams encountered mainly organizational conflicts relative to time issue (47%) while the tri-cultural virtual teams encountered cognitive conflicts related to theoretical issues such as the problem definition (39%).

The ANOVA conducted on the pre-test and the post-test reveal significant Culture main effects. The Hong Kong participants considered “goal compatibility” more important than did the French and the Dutch. The same pattern of results is observed for both pre-test and post-test. However, the HKNET participants declared in the post-test ( $m=7.3$ ,  $SD=1.9$ ) that goal compatibility was less important ( $t(81)=1.937$ ,  $p=.056$ ) than they expected ( $m=7.8$ ,  $SD=1.5$ ). Contrary to what we assumed, the paired test comparisons revealed no significant attitude change between the pre-test and the post-test regarding in-group preference. As presented in Table 3, each national team showed a significant preference for the in-group (national team) in both pre- and post-test. However, the discrepancy in the feeling of compatibility between national teams was generally reduced after the virtual collaboration and associated to a diminution of the in-group favoritism change the general aspect of the pattern of compatibility. This effect is particularly strong for the Dutch team in the post-test ( $F(2,68)=1.543$ ,  $p=.2211$ ). They felt roughly as compatible to themselves ( $m=7.4$ ) as to the French ( $m=6.0$ ) and Hong Kong ( $m=6.0$ ).

Ingroup	Target (Pre)	Pre-Test <sup>a</sup>			Target (Post)	Post-Test <sup>a</sup>		
		N	m	SD		N	M	SD
FR	FR**	19	8.74	1.3	FR <sup>ns</sup>	18	7.9	1.84
NL		37	6.21	1.53		33	6	2.9
HK		26	5.65	1.75		23	6.48	2.9
FR	HK**	18	5.33	1.75	HK*	18	6.22	2.7
NL		36	5.5	1.65		34	6	2.3
HK		26	8.115	1.3		26	7.96	1.9
FR	NL**	19	6.84	1.57	NL <sup>ns</sup>	19	6.9	2.5
NL		37	8.02	1.6		37	7.4	1.9
HK		26	6	1.32		26	6.34	2.6

<sup>a</sup> See Table 2.  
\*\* Target (Pre) FR:  $F(2,66)=20.89$ ,  $p<.0001$ ,  $power=1$ ; Target (Pre) HK:  $F(2,66)=28.514$ ,  $p<.0001$ ,  $power=1$ ; Target (Pre) NL:  $F(2,66)=9.775$ ,  $p=.0002$ ,  $power=.987$ .  
\* Target (Post) HK:  $F(2,68)=5.256$ ,  $p=.007$ ,  $power=.826$   
<sup>ns</sup> Target (post) FR:  $F(2,68)=3.11$ ,  $p=.051$ ,  $power=.572$ ; Target (Post) NL:  $F(2,68)=1.543$ ,  $p=.2211$ ,  $power=.305$ .

Table 3. Means, Standard of Deviation and Significance: Pattern of Compatibility Pre-test and Post-test

The results of the associated 3 (Culture: Hong Kong versus French versus Dutch) \* 2 Cultural Diversity (Bi-cultural versus Tri-cultural) between-subjects ANOVA for the second part of the post-test revealed no significant main effect of the variable Cultural Diversity or interactive effect. One single main effect was measured. If all the participants enjoyed the collaboration ( $m=7$ ,  $SD=1.6$ ), the French participants ( $m=5.9$ ,  $SD=1.8$ ) liked it significantly less ( $p=.002$ ) than the Dutch ( $m=7.15$ ,  $SD=1.3$ ) and significantly ( $p=.0006$ ) less than the Hong Kong participants did ( $m=7.3$ ,  $SD=1.8$ ). This result is congruent with the general evaluation of the French participant of their learning experience.

The Anova conducted on the item “Which level of conflict did you experienced during the project between the participants/national teams?” (from 0=“very low level” to 10=“very high level”) revealed no significant main effect ( $m=4.63$ ,  $SD=2.4$ ). From experience, the participants always expect the cultural differences to be a great source of problem (e.g., Vogel et al., 2001). At the end of the project, the participants declared that the conflicts were mainly: Organizational: participants did not stick to the schedule (37.35%), Cognitive: concern the problem to solve and its definition (35.8%), Social: lack of communication and involvement (17%), Cultural: Some problems to bridge cultural gaps (9.85%)

The first set of results relative to *Normative and cultural need for hierarchical structure* lead us to not reject the first research proposition. Indeed, the interactive national teams changed significantly their normative cultural need for hierarchical structure and converged toward a multicultural virtual team

norm (H1). However, in a condition of high cultural diversity, the participants have to understand and integrate diverse norms and subjective meanings and therefore we assume that the normative cultural need for hierarchical structure will emerge differently in a bi-cultural condition (Low social diversity) and in a tri-cultural dimension (High social diversity) (H2). However, the results indicated that the participants did not answer differently to the questionnaires pre-test and post-test form in function of the cultural diversity of the multicultural virtual team they belong to, except for the item that characterized “leadership requirement”: participants that belong to the bi-cultural multicultural virtual team considered the presence of a leader less important than the participants that belong to the tri-cultural virtual teams. Size of the groups being controlled and balanced, the statistical results lead us to reject (H2) from a normalization point of view but H2 cannot be rejected when leadership is concerned. Therefore, and congruently to the descriptive results, we conclude that less cultural and social diversity required less hierarchy and leadership.

The second set of results relative to *pattern of feeling of compatibility* lead us to reject the third proposition. The interactive national teams did not change significantly the pre-existing pattern of interpersonal compatibility toward a superordinate multicultural virtual team identity (H3). However, the discrepancy in the feeling of compatibility between national teams was generally reduced after the virtual collaboration and a general diminution of the in-group favouritism observed. We could argue that the Dutch reached a shared group Identity and than the reciprocal prejudice Confucian versus western diminished during the six weeks of virtual collaboration.

The third set of results revealed that participants appreciated the project differently. The lowered sense of social and professional learning reported in the post-test are troubling. The French had a quite negative attitude toward the project or perhaps too high initial expectations perhaps linked to the lack of previous experience they had working in multicultural teams (9.5%). This can be first related to the dimension of Uncertainty/Avoidance, linked to the ability to apprehend stressful situation (Hofstede, 1983). Indeed, the member of French culture have more difficulties to deal with uncertain situations including a low level of control on the outcome: first participation of the section in the project, difficulty to master English language, high group cohesion, lack of professional experience in multicultural team, forced compliance.

The lowered sense of social and professional learning reported in the post-test for the Dutch are less striking and Hong Kong participants reported virtually no change. This is more encouraging but still warrants consideration. In no case did post-test results exceed pre-test expectations. Initial expectations were quite high, however, and perhaps would be tempered in future interactions. Recall that this was typically the first virtual team experience for the participants. The results concerning conflict are encouraging. Indeed, the participants always expect the cultural differences to be a great source of problem. However, they did not experience a high level of such conflict within the multicultural virtual teams.

To conclude, the results reflect that a team spirit had emerged in the virtual team. In terms of social perception (Tajfel, 1981), the members of the virtual team perceived themselves as member of a virtual group without meeting each other in person. The team spirit that emerged was quite positive. The Hong Kong participants performed well and took a lot of initiative to support their virtual group while we could have expected them to be more oriented toward the success of their ingroup/national team (Earley, 1993). Concerning the Europeans, the pooled aspect of the contribution into a final e-report generated more frustration for the French than for the Dutch participants. In a Western and individualist power oriented culture, social comparison and validation are important in the virtual collaboration and may explain some of the French frustration about the process (Williams et al., 1981).

## 5 CONCLUSIONS AND LESSONS LEARNED

Overall, we learned that supporting virtual teamwork and team spirit with currently available off-the-shelf technology is possible, as demonstrated in this study. It was appreciated by the students; as one noted, "It was a valuable experience to have the chance to use up-to-date technology such as video conferencing and virtual team tools."

Once technology infrastructure was stable and presented no barrier to participation, the observed factors that determined team performance were social by nature. In virtual teams, each social factor is a potential hurdle that must be dealt with before a team can effectively perform its task. All the factors interact heavily with each other. The more a factor is linked to social identity, the harder it is to influence the impact of that variable on the performance of a virtual team.

Divergences can be overcome in stimulating the development of common terminology and background in the group. The results proved that participants learned much about each other's culture. At a fundamental level, we learned that culture is more malleable than expected. Cultural differences can be overcome and can become a springboard for innovative collaboration. Individuals belonging to diverse cultures, who interact virtually, modify their pre-existing cognitive schemes and meta-knowledge toward a more tolerant perspective. As one student noted, "Continuous communication can usually avoid confrontation and resolve conflicts."

Participants also learned they had to be intrinsically motivated to participate in such teams. The definition of the tasks, the challenge to complete them, the degree of freedom to commit oneself, the autonomy provided by ICT tools, task-centred leadership and the attentive presence of the instructors are central to a successful collaboration and to its appreciation. Once more, culture should be taken in account to balanced cultural susceptibility and to balance pooling and social comparison within and between the ingroup.

The organisation of the national teams that comprised each virtual team allowed the participants to work face-to-face and to discuss many issues before spreading information and making decisions amongst the virtual team. In the e-world, decentralisation is not a synonym for chaos. Indeed the participants focused principally on reaching a consensus in defining problems (i.e., mainly based on their different professional backgrounds) and setting about solving them.

The ICTs that support a decentralised network of communication between participants coming from different cultural and professional backgrounds facilitate divergent thinking, fluency of information spread and thus association of new ideas. Those cognitive, but social, activities are important factors to creativity. As one Hong Kong student noted, "These experiences helped me to develop myself, to be more considerate and creative."

To conclude, the characteristics of virtual teamwork (and especially the fragile interaction processes) call for a certain set of qualities that the team members should possess. The qualities that were observed to positively affect the teamwork during the HKNet project were discipline, assertiveness and the ability to express oneself clearly and concisely. As noted by a student, "I have learned to be considerate, especially when working with team-mates with different cultures, working styles and expectations."

After just a few years' practice in the virtual world, we learned more about the reality of virtuality that we could write about. The development of new e-modes of communication is changing the nature of group collaboration, its functionality and its productivity. Metrics, such as distance between group members or time zones, no longer form an obstacle to multicultural and remote collaborations. The fact that e-modes of communication rely on a fast spread of information and decentralised communication networks, stimulates both problem-solving and creative activities. A decentralised network of communication is not a synonym for chaos. Once the basic technical barriers have been removed, the main issues to deal with are organisational and social. Indeed, firstly, the paper concludes that the organisational structure required to support human e-interactions is central to

efficient e-collaborations. We recommend a “sandwich” structure when designing virtual team projects. This generally means starting with a same time/same place meeting, continuing with asynchronous distributed work and concluding with a same time/same place meeting. Reserve space for same time/same place meetings or videoconferences to solve conflicts when they emerge.

Virtual meetings and collaboration are much more than a technological substitution for the traditional face-to-face meeting. A videoconference that typically supports virtual meetings is not the single tool that can facilitate the development of virtual team identity. Indeed, simulation of face-to-face required a portfolio of ICT tools that, when well supporting a socially structured e-environment, influence human interactions and impact processes of the virtual team at multiple levels.

Experiencing virtual team spirit without meeting physically person-to-person is a reality, but to be of high quality, requires a high level of engagement, motivation to search for compatibility rather than differences with the other participants. The future of ICTs remains dependent on human factors.

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