Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2011 Proceedings - All Submissions

8-7-2011

Diversity, Group Behavior, and Performance of Short Duration Ad Hoc Virtual Teams: Findings from a Laboratory Experiment

Souren Paul
Nova Southeastern University, souren_paul@yahoo.com

Fang He
Peabody Energy Risk Management Group, helen0908@yahoo.com

Follow this and additional works at: http://aisel.aisnet.org/amcis2011_submissions

Diversity, Group Behavior, and Performance of Short Duration Ad Hoc Virtual Teams: Findings from a Laboratory Experiment

Souren Paul

Nova Southeastern University

Graduate School of Computer & Information Sciences

Fort Lauderdale-Davie, Florida 33314-7796

Souren_paul@yahoo.com

Fang He

Peabody Energy

Risk Management Group

St. Louis, MO 64101

helen0908@yahoo.com

ABSTRACT

The purpose of this research is to examine whether the team diversity and psychological factors (such as, trust and motivation) can influence performance of short-duration, ad-hoc virtual teams engaged in problem solving tasks. We focus on the diversities of the members of virtual teams across national culture, educational specialization, and collaboration technology proficiency. A laboratory experiment was conducted involving virtual teams that were engaged in data model design. The results indicate that educational specialization diversity affects trust and motivation in the virtual teams. We also find that both trust and collaboration technology proficiency diversity influence performance of the virtual teams. The findings of the study highlight the importance of diversity and psychological factors in shaping the performance of short-duration virtual teams.

Keywords

Virtual team, team diversity, national culture, educational specialization, collaboration technology proficiency, trust, motivation, and team performance.

INTRODUCTION

The growth of information and communication technologies (ICT) has opened the frontiers for distributed works. Teams and groups, whose members are dispersed across time and/or place, use these technologies to share information and coordinate their activities. These are virtual teams or virtual work groups. With the globalization of business and increased market competitions, organizations are trying to make optimum use of their distributed expertise and skills by forming virtual teams and/or groups, which is the focus of this study. We define virtual team as the collection of dispersed individuals brought together by information and telecommunications technologies to accomplish one or more organizational tasks (Powell, Piccoli, and Ives, 2004). The team members may be dispersed across time, place, and/or organizations.

The multi-faceted nature of virtual teams has been discussed in the literature (Dube and Pare, 2002). The key characteristics of virtual teams are the degree of reliance on ICT, team members' proficiency in ICT, team size, prior shared experience, task duration, task interdependence, and cultural diversity. Both information systems (IS) and management researchers are attempting to unravel various aspects of these characteristics of virtual teams. The focus of this research is on the relationship that diversity of the team members has with team behavior and performance. Although team diversity has been studied in management research, we have chosen to focus on two relatively less explored areas of team diversity, - diversity in team members' proficiency in collaboration technology and team members' educational specialization. Dahlin, Weingart, and Hinds (2005) report the effect of team members' diversity in educational specialization on the range and depth of information use. We did not find any major study on diversity of members' proficiency in collaboration technology.

Another distinctive feature of our study is our emphasis on short duration and ad hoc teams. Traditionally researchers tend to study virtual teams that are intact (i.e. existing teams with stable membership) and are engaged in projects of long duration. The members of these teams have reasonable time to know each other and develop relationship. However, short duration and ad hoc virtual teams play crucial role in knowledge works (Lind, 1999), emergency response situations, and in providing temporary support on technical problems. Developing trust, cohesion and building relationships are difficult in short duration virtual work (Dube and Pare, 2002; Driskell, Radtke, and Salas, 2003). De Pillis and Furumo (2007) find that for projects of short duration, virtual teams have lower performance than face-to-face teams. Thus, it is important to understand how diverse members of short-duration and ad hoc virtual teams trust each other, work together, and perform effectively.

The psychological factors, such as trust and motivation explain the collective perception of the members of virtual teams that shapes their problem solving processes and outcome. Different location of the team members and the computer-mediated communication mode can create disparities in working contexts in the virtual teams and can lead to distrust and disappointment. When team members are dispersed, it is difficult to create the bonds of cohesion that can lead to trust and motivation based on assessments of ability, benevolence and perceived inclusiveness. The challenge of developing trust and motivation among the team members can become complex when team members belong to different cultures and have different educational specializations.

Although prior research has looked into the effects of cultural diversity on the processes and the performance of groups, no study has focused on the relations that educational specialization and collaboration technology proficiency diversity have on the behavior and performance of virtual teams. However, these diversities are important constructs in organizational studies. Wiersema and Bantel (1992) find that educational specialization heterogeneity of top management teams is associated with strategic change in organizations. We propose and validate a research model (Figure 1) that links national cultural, educational specialization, and collaboration technology proficiency diversities with psychological factors, and the performance of short duration and ad hoc virtual teams.

The results of our study indicate that educational specialization diversity affects trust and motivation in the virtual teams. We also find that collaboration technology proficiency diversity and psychological factors are related to the performance of these teams.

In the next section present our research model, review of the extant literature, and propose the hypotheses of our study. Next, we discuss the research method, which is followed by the presentation of the results. We end the paper with a discussion on the findings, the limitations of our study, and the conclusion.

LITERATURE REVIEW AND THEORY DEVELOPMENT

The research questions of this study have been integrated in the research model, shown in figure 1. The theoretical foundation of the research model is discussed in this section. We discuss the prior studies on the constructs involved in the research model and attempt to establish the model that we start with the discussion of the major constructs

Figure 1. Proposed Research Model
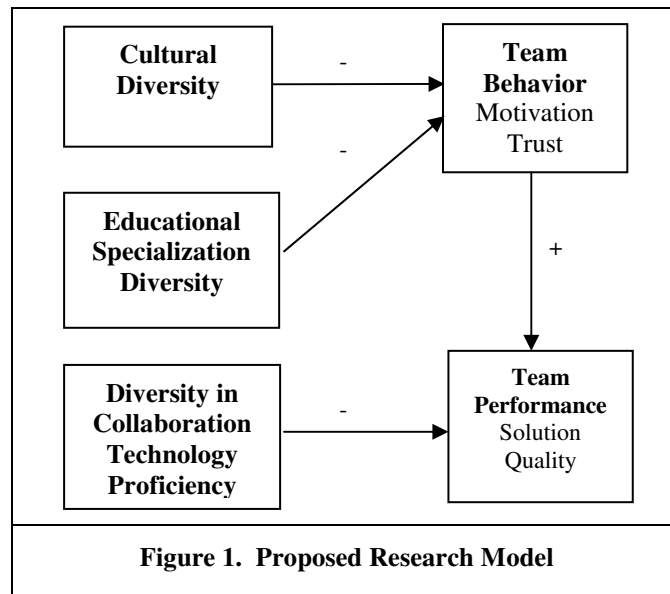
Diversity in Virtual Work Groups

Diversity within a work group refers to its composition in terms of the distribution of demographic traits and cognitive differences manifested as surface-level and deep- level attributes (Chidambaram, 2005). Surface level diversity is important in face-to-face teams. Team members can make reasonable estimates of age, gender or racial ethnic background of the other members and can attempt to assess the similarities or dissimilarities that exist in the teams (Jackson, May, and Whitney, 1995). Individuals use these characteristics to assign themselves and others to social classifications involving ascribed pattern of thoughts, attitudes and behaviors (Fiske, 2000). Tajfel and Turner (1986) suggest that the individuals are likely to evaluate positively and identify with persons and groups whose members appear to hold the same overt features that they do.

Deep level diversity refers to differences among team members' psychological characteristics, including personalities, values, and attitudes (Jackson et al., 1995). These are latent individual differences that are expressed in the behavioral patterns, verbal and nonverbal communications, and exchange of personal information of the team members (Harrison, Price, Gavin, and Florey, 2002).

The members of virtual teams do not usually meet face-to-face and thus, they do not immediately perceive the surface level diversity. The members may perceive differences in ethnicity through the language and communication patterns used in conversations. The language and communication patterns of a team member are influenced by his/her culture. Culture is defined as the set of deep level values associated with societal effectiveness, shared by an identifiable group of people (Maznevski, Gomez, and Noorderhaven, 1997). Culture plays a major role in information processing of individuals. Cultural values influence the perceptual filter through which an individual interprets information needed to make decisions (Hofstede, 1980). In a cross-cultural virtual team, members analyze and interpret facts using the cues provided by their respective cultures. A major source of cultural diversity in virtual teams arises from the differences in team members' national cultures.

National culture is the collective programming of the mind, which distinguishes one group or category (nation) from another (Hofstede, 1980) and it helps us understand why the people from different countries may think, feel and behave differently when faced with problems. Hofstede identified five major dimensions of national culture along which the people of different countries differ. These dimensions are individualism/collectivism, power distance, uncertainty avoidance, masculinity femininity, and long-term orientation and short-term orientation. Because of the differences of the individual members along these dimensions, the virtual teams have national cultural diversity.

In order to be more reactive to competitive change, cross-functional or functionally diverse teams are designed to react quickly from a broad perspective (Kanter, 1989). Functional diversity, which refers to the total number of specialties of team members, has been found to be both positively and negatively associated with team effectiveness (Sundstrom, McIntyre, Halfhill, and Richards, 2000). The diversity can improve a team's ability to communicate with external parts of the organization, but it can adversely affect internal group processes such as increasing conflict and reducing cohesion within the team (Ancona and Caldwell, 1992). Prior research suggest that team members with similar functions share a common language and orientation which makes communication easier (Kiesler, 1978), and some studies has shown that greater functional diversity is related to lower performance (Haleblian and Flinkelstein, 1993). Closely related to functional diversity is educational specialization of team members. "Educational diversity relates to the different sets of task-relevant skills, knowledge, and abilities team members possess as a function of their educational backgrounds" (Dahlin, Weingart, and Hinds, 2005, page 1008). However, there is a difference between the functional diversity and educational diversity. As Dahlin, Weingart, and Hinds (2005) argue, functional areas have distinctive characteristics and represent to some extent social categorizations in organizations. Moreover, functional areas are subjected to organizational goals and objectives; in contrast, a team member's dominant educational background (i.e. his/her educational specialization) has less distinctive attributes that can be ascribed to a social category. Educational backgrounds shape how an individual processes information. Thus, educational specialization diversity is an important construct for the teams whose members have to process large information to perform a group task.

Members of virtual teams use collaboration technology to communicate with each other and perform the group task. Collaboration technologies include a wide range of tools from electronic mails and chats to electronic meeting and video conferencing systems. Powell, Piccoli, and Ives (2004) suggest that technical expertise of the members shapes the task processes in virtual teams. Lack or deficiency in technical expertise adversely affects the performance of virtual teams (Kayworth, Leidner, and Mora-Tavarez, 2000). Qureshi and Zigurs (2001) suggest that the success of virtualization depends on how the collaboration technology is used in the organizations. Diversity in collaborative technology proficiency can arise from different levels of abilities in using conferencing systems (e.g. NetMeeting), collaboration support software (e.g. Lotus Notes), group support systems (e.g. GroupSystems), and other relevant types of collaboration technologies. Prior research has not specifically addressed the issue of diversity in collaboration technology proficiency in the virtual teams.

The effect of diversity on group behavior is discussed next in the paper.

Diversity and its effect on group behavior in Short-Duration and Ad hoc Virtual Work Groups

Diversity has both positive and negative effects on group work. The people of different cultures bring a variety of perspectives and outlooks to a task. Diversity also reduces the probability of groupthink (Adler, 1990). However, diversity increases the complexity of group work (Adler, 1990); has negative impact on communication and interpersonal attraction (Adler, 1990; Storey, 1991). Rogers and Bhowmick (1971) found that heterogeneous groups suffered from delayed transmission of messages, message distortion, and restriction of communication channels. The cultural values influence group members' preferences for social interaction norms (Bettenhausen and Murnighan, 1991; Earley, 1993). Thus,

multicultural groups find cooperative decision-making difficult (Kirchmeyer and Cohen, 1992; Watson, Kumar, and Michaelsen, 1993).

Research on socio-emotional development in virtual work groups focuses primarily on group cohesion and trust (Powell, Piccoli and Ives, 2004). Dube and Pare (2002) suggest that the development of trust and cohesion and building relationship in short duration virtual teams are expected to be difficult. However, Meyerson, Weick, and Kramer, (1996) propose that temporary groups exhibit trusting behavior, which has been referred to as "swift trust" in the literature. Trust involves interpersonal relationship building and plays a key role for effective information sharing in virtual settings. Trust occurs when a person is confident in and willing to act on the basis of the actions and decisions of others in the team (McAllister, 1995). Trust has been considered as critical in managing people who cannot meet face-to-face (Handy, 1995); it facilitates effective interactions when members are willing to open themselves to each other and cooperate to solve a problem (Jarvenpaa, Knoll and Leidner, 1998). If team members distrust each other, they may refuse to cooperate or make contributions essential to team performance (Davis, 2004). Intricately connected with the issue of trust in virtual teams is the motivation of the team members in the group work. Once team members have a sense that they belong to a team, they desire to be passionate about what they do and are motivated to perform a better job (Crystal, 2007). As a result, members who are made to feel responsible for the teamwork will be either intrinsically or extrinsically motivated to share information effectively and facilitate relationship building. Thus, in this research we focus on trust and motivation, two fundamental socio-emotional processes that foster team effectiveness in virtual teams. Culturally and educationally diverse teams have diversity in processing situational information and will have difficulty in developing trust and motivation. We, therefore, hypothesize:

> **H1a:** *In short-duration and ad hoc virtual teams, national cultural diversity will have a negative relationship with the trust that exists among the team members.*

> **H1b:** *In short-duration and ad hoc virtual teams, educational specialization diversity will have a negative relationship with the trust that exists among the team members.*

> **H2a:** *In short-duration and ad hoc virtual teams, national cultural diversity will have a negative relationship with the motivation of the team members.*

> **H2b:** *In short-duration and ad hoc virtual teams, educational specialization diversity will have a negative relationship with the motivation of the team members.*

Team Performance – Solution Quality

Prior virtual team research has widely reported the interrelated relationship between psychological factors and the solution quality. Motivation, as well as cohesion and satisfaction, contributes to virtual team effectiveness by promoting more efficient use of team resources while reducing implementation errors (Rosen, Furst, and Blackburn, 2007). Motivation development investment is essential to increase the performance of a virtual team (Windsor, 2001). Like motivation, trust is also an important socio-organizational challenge inherent to the project-based nature of virtual team (Rezgui, 2007). The literature on trust suggests that trust is important in determining the success and failure of virtual team.

The use of collaboration technology facilitates effective sharing of information and coordination team activities. The diversity of collaboration technology proficiency of the team members will result in asymmetrical and asynchronous interaction among team members. The members who are proficient in the use of technology will dominate the use of the system and will exert influence over discussions (Shandor, 1995). Thus, information sharing in these teams will not be uniform which will adversely affect the quality of solution offered by the team. Moreover, we expect that teams with high diversity in collaboration technology proficiency will have problem in performing the assigned task smoothly. Team members who are proficient in using collaboration technology will interact and perform tasks easily while others will lag behind. Thus, the group members will have difficulty in synchronizing their group work. However, in the teams with low diversity in collaboration technology proficiency, team members will either be able to synchronize their activities easily (when all members have high level of proficiency in collaboration technology) or will make some adjustments to establish a minimum level of synchronization (when all members have low level of proficiency in collaboration technology).

We, therefore, hypothesize:

> **H3a:** *In short-duration and ad hoc virtual teams, the greater the trust among the team members, the higher will be the quality of the final solution.*

> **H3b:** *In short-duration and ad hoc virtual teams, the greater the motivation of team members, the higher will be the quality of the final solution.*

H3c: In short-duration and ad hoc virtual teams, the higher the diversity in collaborative technology proficiency of the team members, the lower will be the quality of final solution.

RESEARCH METHODOLOGY

We conducted a laboratory experiment to test the hypotheses of our research. The details of the research method are discussed in this section.

Subjects

A total of 72 students (62.5% graduates, and 37.5% undergraduates) majored in business, computer science, and engineering from a large Midwestern university in the United States were involved in the research. On average, they were 24 years old and had 2 years of work experience. All subjects were volunteers and received extra credit for their participation. Subjects were randomly assigned to 24 teams, with 3 members in each. However, one group had only 2 participants in the experiment. The data collected from the group was dropped and not used for any analyses.

Task description

The task chosen for this study is a problem-solving task that has a demonstrable correct answer (McGrath, 1984). Given that all participants of our study had taken courses on database management, we selected the task of designing a data model (Entity Relationship Diagram) for a database application. Each participant was provided with one page of introduction paper which listed four piece of unique information. The unique information provided the participants regarding the entities, attributes, cardinalities, and relationships that should be used for designing the database. The participants were asked to share information anonymously and synchronously and draw an entity relationship diagram (ERD) by using ER Assistant 2.10, a Computer Aided Software Engineering (CASE) tool. The ERD was the final solution provided by the group. Group members voted on the final solution. Stasser (1992) have used this kind of hidden profile tasks (i.e. where each group member has unique yet complimentary information) to examine information sharing. This type of task is important for group laboratory research because it simulates an important characteristic of "real-world" tasks where each member holds unique information (Mennecke, 1997).

Collaboration tool and training

The tool used in our experiments was IBM's Lotus Sametime, a type of software for group collaboration over the Internet. As a synchronous groupware application, Sametime facilitates communication among geographically dispersed coworkers. The tool provides support on text message exchange, screen sharing, program sharing, whiteboard, audio-conferencing, video-recording, and allows for voting on and ranking of the solution. Subjects were scheduled into four one-hour training sections to be orientated to the phases of the experiment and features of the software as well as the CASE tool used in the experiment.

Variable identification

This study involved three independent variables (national culture, educational specialization, and collaboration technology proficiency diversity), and three dependent variables (trust, motivation, and solution quality). Trust, motivation, and collaboration technology proficiency were measured using 5-point Likert scale questionnaires. We used objective measures to calculate the other variables used in this study.

National Cultural and Educational Specialization Diversities - We collected the demographic data of each participant, which was used to calculate national cultural and educational specialization diversities. The participants completed a questionnaire in which they indicated their nationalities, country of residence, duration of residence, and areas of specialization (i.e. majors). Each nationality was considered as a category of national culture. However, a subject who lived in a host country for ten years or more, was considered to have greater levels of adaptation to the host country's way of life. Goldlust and Richmond (1974) demonstrate that education and length of residence are the most important determinants of immigrant adaptation. In order to measure educational specialization diversity, each area of major was considered as a category of educational specialization. Following the standard approach for categorical variables, we calculated entropy-based index (Teachman, 1980) to measure national culture and functional diversities. The entropy-based index was calculated as:

Diversity$= \sum -P_i \ln(P_i)$,

where P_i indicates the proportion of group members belonging to each category of diversity. Thus, if all three members of a group were U.S. nationals, the national cultural diversity index would be 0.000. In a group that had two U.S. and one Indian

nationals, the diversity index was calculated as 0.637. Similarly, we calculated the educational diversity index of each group. Jehn, Northcraft, and Neale (1999) used similar measures for informational and social category diversity.

Trust and Motivation – Four items developed by McAllister (1995) were used to measure trust. Motivation was measured by 4 items. The questionnaire items measuring constructs are listed in Table 1.

Diversity in Collaboration Technology Proficiency – Three items used by Paul, Seetharaman, Samarah, and Mykytyn (2004) were used to measure collaboration technology proficiency of each participant in the meeting. Individual member's collaboration technology proficiency was measured by taking the average of the scores received on the three items related to the skill. The standard deviation of the scores of three members was used as a measure of the diversity in collaboration technology skill of a team.

Solution quality – The solution quality was evaluated by the points a team obtained in three information sharing stages: distribution, explanation, and application. Ten points were assigned for each stage. Figure 2 presents the algorithm used to evaluate ISE. The evaluation process started at the Application phase, which indicated the final solution of each group was checked first to see whether there was an error in the solution. If not, the group got full points in each of the three phases because it is impossible to make a 100 percent correct solution with missing value or errors in the information sharing process. Otherwise, the messages about task information distribution were then checked to see whether there was an information distribution missing or a false distribution regarding the error. If there was, one point was deducted from the Distribution phase. But if information was indeed distributed correctly, the messages about task information explanation were then checked to see whether there was an explanation missing or false explanation regarding the error. If there was, one point was deducted from the Explanation phase; otherwise, the group lost one point from the Application phase. Each decision loop checked only one error, and the loop did not end until all errors were identified. The solution quality was the average of the scores for information distribution, explanation, and application.

| Table 1. Summary of Measurement Scales	
Construct	Measure
Trust	• We can freely share our ideas, feelings, and hopes. • If I shared my problems with my members, I know they would respond constructively and caringly. • My members approached their jobs with professionalism and dedication. • I can rely on my members not to make my job more difficult by careless work. Scale: 1 (Strongly disagree) to 5 (Strongly agree)
Motivation	• I was motivated to perform better in the teamwork. • I feel enthusiasm about the teamwork. • As a team, we tried our best to do the work. • The more effort we put into the project, the more we gained from the teamwork. Scale: 1 (Strongly disagree) to 5 (Strongly agree)
Collaboration Technology Proficiency	How much have you used the following types of IT applications? • Conferencing systems (e.g. NetMeeting) • Collaboration support software (e.g. Lotus Notes) • Group Decision Support Systems (e.g. GroupSystems) Scale: 1 (Not at all) to 5 (Extensively)

.
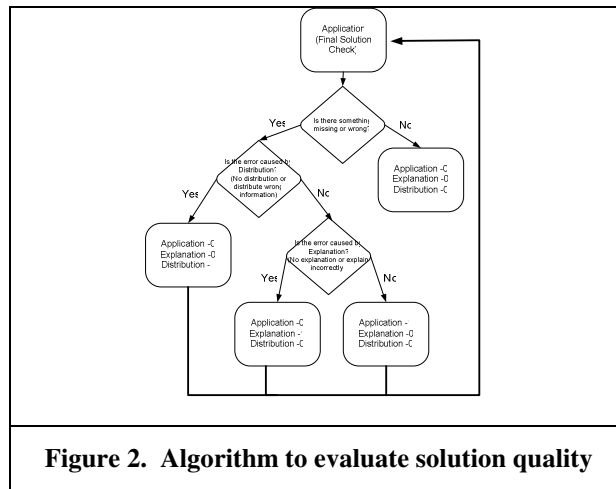
Figure 2. Algorithm to evaluate solution quality

Experimental procedures

Members in each group were assigned to laptop workstations in three different rooms. The team members could not see each other. Their identities were not revealed. The interactions were anonymous. Each member was given log in identification and password that was used to access the meeting session. One of the researchers monitored the group work from a separate room. The major activities of the experiment were:

- Team members participated in a discussion. Each member shared the uniquely held information about the data model.

- Team members selected one from within the team to draw the ERD (referred to as Drawer). The other members could observe the drawing process but could not directly modify the diagram. They had to request the drawer to make any change in the ERD.

- Once the team finished the ERD, the team members completed a posttest questionnaire that collected data on demographic variables and psychological factors.

Figure 3 shows a screen from the experiment. In the two pilot studies, the subjects took less than 60 minutes to complete the first two activities of the experiment. Each session designed to last for 90 minutes.
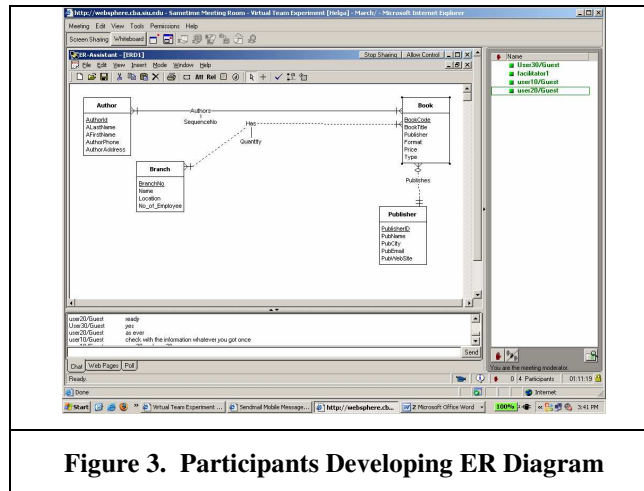

Figure 3. Participants Developing ER Diagram

RESULTS

Reliability and validity

In Table 2, we present the reliability statistics for the constructs used in the study. Nunnally (1978) suggests that a reliability of a construct between 0.60 and 0.80 should be acceptable. As shown in Table 2, the reliabilities of all constructs are between 0.69 and 0.86, thus passing the test of construct reliability. Fornell and Larcker (1981) propose that the average

variance extracted from a construct should exceed 0.50. As Table 2 indicates, the average variance extracted from each construct exceeds 0.50.

Table 2. Convergent validity test		
Constructs	Construct reliability [a]	Portion of variance extracted [b]
Motivation (with 4 indicator items)	0.860	71.82%
Trust (with 2 indicator items)	0.687	76.16%
Collaboration technology proficiency (with 3 indicator items)	0.823	73.94%

[a] Estimated using Cronbach's α coefficients.

[b] Estimated by computing, squared sum of factor loadings/number of factors of the underlying construct.

Hypothesis testing

The hypotheses were tested through regression analyses with a level of significance of 0.05. Any weak significance level in the range of .05 to .10 was treated as suggestive of the nature of relationship between the variables.

First, we regressed the psychological factors (i.e. trust and motivation) on national cultural and educational specialization diversity indices. Both trust and motivation were found to be influenced by educational specialization diversity but not by national cultural diversity (table 3).

Table 3. Results of regression analysis for trust		
Independent Variables	Trust	Motivation
Intercept	4.850****	1.962****
National Cultural Diversity	-0.056	-0.010
Educational Diversity	-0.469**	-0.160**
R-Square	0.358	0.319
F	5.58	4.69
Prob. (F)	0.012	0.021
N	23	23
Hypotheses Supported?	H1a: No H1b: Yes	H2a: No H2b: Yes
* p<0.10; ** p<0.05; *** p<0.01; **** p<0.001		

Next, we regressed solution quality on trust, motivation, and collaboration technology proficiency diversity. The results of the regression analysis are presented in table 4. Solution quality was positively influenced by trust and negatively affected by collaboration technology proficiency diversity. However, the regression analysis did not reveal any significant effect of motivation on solution quality. Motivation has strong correlation with trust ($r=0.723$, $p<0.0001$) and the overall regression model was found to be highly significant ($p=0.0007$; $R^2=0.585$). We wanted to ensure that the regression results were not distorted because of multicollinearity between trust and motivation. We found that the average variance inflation factors (VIF) for these two predictors in the regression were greater than 2.00, which indicated that multicollinearity might have existed between trust and motivation.

The existence of multicollinearity in the regression model might have made the coefficients estimated through ordinary least squares fit imprecise. We, therefore, used ridge regression, which is more appropriate than ordinary least squares regression in estimating regression coefficients when predictors are multicollinear (Draper and Van Nostrand, 1979; Hoerl and Kennard, 1970a; Hoerl and Kennard, 1970b). By allowing a small amount of bias in the estimates, ridge regression can combat the influence of "multicollinearity" and help to obtain more reasonable coefficients (Hoerl and Kennard, 1970a). This technique involves the introduction of a small biasing parameter k in the model used for estimation. Our results indicate that the use of ridge regression may be useful in obtaining improved point estimates of the parameters of the research model. As shown in figure 4, motivation and trust have positive relationship with solution quality and collaboration technology proficiency diversity has the opposite effect on it. While interpreting the results from each graph in figure 4, we consider the portion of the graph in which the coefficient estimate seems to have stabilized.

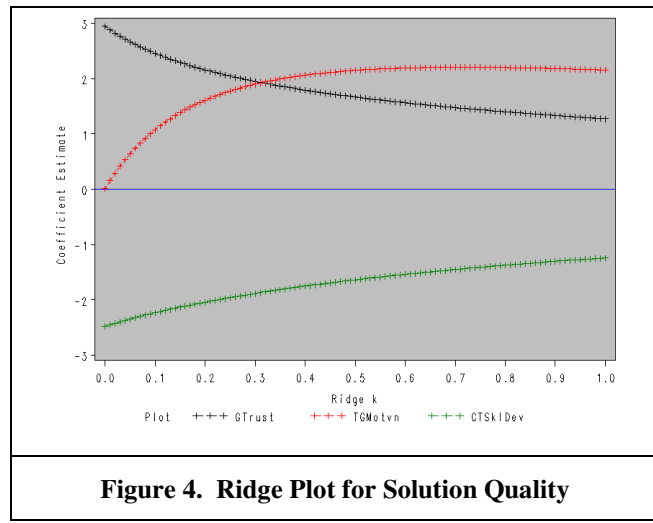| Table 4. Results of regression analyses for solution quality	
Independent Variables	Solution Quality
Intercept	14.859***
Trust	2.942**
Motivation	0.010
Diversity in Collaboration Technology Proficiency	-2.473***
R-Square	0.585
F	8.92
Prob. (F)	0.0007
N	23
Hypotheses Supported?	H3a: Yes H3b: No H3c: Yes
* p<0.10; ** p<0.05; *** p<0.01; **** p<0.001	

Figure 4. Ridge Plot for Solution Quality

DISCUSSION

Based on the findings of our study, we suggest that in short-duration and ad hoc virtual teams, educational specialization diversity is an important predictor of trust and motivation of the team members. When team members have different educational specializations, they comprehend situational cues differently. Thus development of situated trust becomes difficult.

We did not find any effect of national cultural diversity in our study. This might have happened because of the experimental task that the participants had to perform. Data model design is a problem solving task. Individual member's cultural beliefs and norms had no role in performing this problem solving task. Dominant part of the information shared in the meeting was on the solution of a technical problem. We might have found significant effect of national cultural diversity on group behavior had we engaged the subjects in a decision making or cognitive conflict task. This remains an agenda for our future research.

Another interesting finding of our study is the negative relationship between collaboration technology proficiency diversity and solution quality. This highlights the need for organizing training sessions for members of the virtual teams to enhance their collaboration technology proficiency.

LIMITATIONS

The participants in this study were undergraduate and graduate business students and not regular users of collaboration technologies. Although these students were excited at the prospect of participating in the electronic meetings, it was difficult to ensure whether the subjects put their best effort to work on the assigned task (which is true with most laboratory research).

The findings of this study are relevant for virtual teams that are engaged in short duration tasks. However, the effects of national cultural diversity on group behavior will be different for virtual teams that are engaged in long duration tasks. Members of these teams have sufficient time to know each other and develop trusting relationships. Whether national cultural diversity hinders the development of trusting relationships in these teams is an important research question that may be pursued in future.

CONCLUSIONS

Although this study marks the beginning of research on short duration virtual teams, we can draw some conclusions from this research. Both educational specialization diversity and collaboration technology proficiency diversity are important in enhancing the effectiveness of short duration virtual teams. Educational team diversity enables virtual teams to have a wider pool of expertise. However, it also hinders the development of trust in these teams. Thus, the critical issue is the proper management of educational specialization diversity in virtual teams. While virtual teams have to include members of diverse educational background, it is important that these members have some degree of familiarity with the task situation and have the ability to exchange messages that can be understood by others in the team. Managers of virtual teams may organize training and orientation session before engaging individual members in the project. The findings of the study also stress the importance of lowering the diversity of team members on their collaboration technology proficiency. Again, this can be achieved by organizing appropriate training sessions (on the use of collaboration technology) for the members of virtual teams. Thus, the success of short duration virtual teams depends on the level of preparedness of the individual members to participate in virtual work.

REFERENCES

1. Adler, N.J. (1990) International Dimension of Organizational Behavior, 2nd ed., PWS, Boston, MA.

2. Ancona, D. G., and Caldwell, D. E. (1992) Demography and design: Predictors of new product team performance, *Organization Science: A Journal of Institute of Management Sciences*, 3, 321-342.

3. Bettenhausen, K. L. and Murnighan, J. K. (1991) The development and stability of norms in groups facing interpersonal and structural challenge, *Administrative Science Quarterly*, 36, 1, 20-35.

4. Chidambaram, L. (2005) Diversity: Is There More Than Meets The Eye? A Longitudinal Study of the Impact of Technology Support on Teams with Differing Diversity, in *Proceedings of the Hawaii International Conference on Systems Sciences*, Big Island, HI.

5. Crystal, S. (2007) Team Collaboration, *http://www.proz.com/translation-articles.*

6. Davis, D.D. (2004) The Tao of leadership in virtual teams, *Organizational Dynamics*, 33, 1, 47-62.

7. Dahlin, K.B., Weingart, L.R., and Hinds, P.J. (2005) Team Diversity and Information Use, *Academy of Management Journal*, 48, 6, 1107-1123.

8. De Pillis, E. and Furumo, K. (2007) Counting the cost of virtual teams, *Communications of the ACM*, 50, 12, 93-95.

9. Draper, N., and Van Nostrand, R. C. (1979) Ridge Regression and James- Stein Estimation: Review and Comments, *Technometrics*, 21, 451- 466.

10. Driskell, J.E., Radtke, P.H., and Salas, E. (2003) Teams: Effects of Technological Mediation on Team Performance, *Group Dynamics: Theory, Research, and Practice*, 7, 4, 297-323.

11. Dube, L. and Pare, G. (2002) The Multi-faceted Nature of Virtual Teams, Working Paper, ISSN 0832-7203, 1-33.

12. Earley, P. C. (1993) East meets west meets mideast: Further explorations of collectivistic and individualistic work groups, *Academy of Management Journal*, 36, 2, 319-348.

13. Fiske, S. T. (2000) Interdependence and the reduction of prejudice" In S. Oskamp (Ed.), *Reducing prejudice and discrimination*, Erlbaum, Mahwah, NJ, 115-135.

14. Fornell, C. and Larcker, D.F. (1981) Evaluating structural equation models with unobservable variables and measurement error, *Journal of Marketing Research*, 18, 1, 39-50.

15. Goldlust, J., and Richmond, A.H. (1974) A multivariate model of immigrant adaptation, *International Migration Review*, 8, 2, 193-225.

16. Haleblian, J., and Finkelstein, S. (1993) Top management team size, CEO dominance, and firm performance: The moderating roles of environmental turbulence and discretion, *Academy of Management Journal*, 36, 844-863.

17. Handy, C. (1995) Trust and the virtual organization, *Harvard Business Review*, 73, 40-50.

18. Harrison, D.A., Price, K. H., Gavin, J. H., and Florey, A. T. (2002) Time, Teams, and Task performance: Changing effects of surface- and deep level diversity on group functioning, *Academy of Management Journal*, 45, 5, 1029-1045.

19. Hofstede, G. (1980) Culture's Consequences: International Differences in Work-Related Values, Sage, Newbury Park, CA.

20. Hoerl, A.E., and Kennard, R.W. (1970a)   Ridge regression: biased estimation for nonorthogonal problems, *Technometrics*, 8, 27–52.

21. Hoerl, A.E., Kennard, R.W. (1970b) Ridge Regression: Applications to Nonorthogonal Problems, *Technometrics*, 12, 1, 69-82.

22. Jackson, S. E., May, K. E., and Whitney, K. (1995) Understanding the dynamics of diversity in decision making teams in Team decision-making effectiveness in organizations, R. A. Guzzo and E. Salas (Eds.), Jossey-Bass, San Francisco, 204-261.

23. Jarvenpaa, J.S., Knoll, K., and Leidner, D.E. (1998) Is anybody out there? Antecedents of trust in global virtual teams, *Journal of Management Information Systems*, 14, 4, 29-64.

24. Jehn, K.A., Northcraft, G.B., and Neale, M.A. (1999) Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Work Groups, *Administrative Science Quarterly*, 44, 4, 741-763.

25. Kanter, R. M. (1989) New Managerial Work. *Harvard Business Review*, 85-92.

26. Kayworth, T. R., Leidner, D. E. and Mora-Tavarez, M. (2000) Leadership Effectiveness in Global Virtual Teams, *Working Paper, Baylor University*.

27. Kiesler, S.B. (1978) Interpersonal Processes in Groups and Organizations, Arlington Heights, Ill.: AHM Publishing.

28. Kirchmeyer, C. and Cohen., A. (1992) Multicultural groups: Their performance and reactions with constructive conflict, *Group and Organizational Management*, 17, 2, 153-170.

29. Lind, M.R. (1999)   The gender impact of temporary virtual work groups, *IEEE Transactions on Professional Communications*, 42, 4, 276-285.

30. Maznevski, M.L., Gomez, C.B., and Noorderhaven, P.W. (1997) The cultural orientations framework and international management research, *Presented at the Academy of International Business Annual Meeting*, Las Vegas, NV, 227-231.

31. McAllister, D.J., (1995) Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations, *Academy of Management Journal*, 38, 1, 24-59.

32. McGrath, J.E. (1984) Groups: Interaction and Performance, Prentice-Hall.

33. Mennecke, B. E. (1997) Using group support systems to discover hidden profiles: an examination of the influence of group size and meeting structures on information sharing and decision quality, *International Journal of Human-Computer Studies*, 47, 387-405.

34. Meyerson, D., Weick, K.E., and Kramer, R.M. (1996) Swift Trust and Temporary Groups, in Kramer, R.M. and Tyler, T.R. (Eds), *Trust in Organizations: Frontiers of Theory and Research*, Thousand Oaks, CA: Sage Publications, 166-195.

35. Nunnally, J. (1978) Psychometic theory, McGraw-Hill, New York.

36. Paul, S., Seetharaman, P., Samarah, I., and Mykytyn, P.P. (2004) Impact of heterogeneity and collaborative conflict management style on the performance of synchronous global virtual teams, *Information & Management*, 41, 3, 303-321.

37. Powell, A., Piccoli, G, and Ives, B. (2004) Virtual teams: a review of the current literature and directions for future research, *The DATA-BASE for Advances in Information Systems*, 35, 1, 6-36.

38. Rogers, E., Bhowmik, D. K. (1971) Homophily-heterophily: relational concept of communication research, in *Speech Communication Behaviour: perspectives and principles*, Barker, L. and E. Kibler, E. (Eds.), McGraw-Hill, New York.

39. Qureshi, S., and Zigurs, I. (2001) Paradoxes and prerogatives in global virtual collaboration, *Communications of the ACM*, 44, 85-88.

40. Rezgui, Y. (2007) Exploring virtual team-working effectiveness in the construction sector, *Interacting with Computers*, 19, 1, 96-112.

41. Rosen, B., Furst, S., and Blackburn, R. (2007) Overcoming Barriers to knowledge sharing in virtual teams, *Organizational Dynamics*, 36, 259-273.

42. Shandor, C. (1995) Change and the Public Forum, *Computer-Mediated Communication Magazine*, 2, 6, http://www.ibiblio.org/cmc/mag/1995/jun/last.html

43. Stasser, G. (1992) Pooling of unshared information during group discussions", In S. Worchel, W. Wood & J.A. Simpson, Eds. *Group Process and Productivity*, Newbury Park, CA: Sage, 1992, pp. 48-67.

44. Storey, B. "History and homogeneity: Effects of perceptions of membership groups on interpersonal communication, *Communication Research*, 18, 2, 199-221.

45. Sundstrom, E., McIntyre, M., Halfhill, TR, & Richards, H. (2000) Work groups: From the Hawthorne studies to work teams of the 1990s and beyond, *Group Dynamics: Theory, Research, and Practice*, 4, 41-67.

46. Tajfel, H. and Turner, J. (1986) The social identity theory of intergroup behavior, *in The social psychology of intergroup relations*, S. Worchel, S. and Austin, W. G. (Eds.), Nelson-Hall, Chicago, 7-24.

47. Teachman, J.D. (1980) Analysis of Population diversity, *Sociological Methods and Research*, 8, 341-362.

48. Watson, W. E., Kumar, K., and Michaelsen, L. K. (1993) Cultural diversity's impact on interaction process and performance: Comparing homogeneous and diverse task groups, *Academy of Management Journal*, 36, 3, 590-602.

49. Wiersema, M.F. and Bantel, K.A. (1992) Top Management Team Demography and Corporate Strategic Change, *The Academy of Management Journal*, 35, 1, 91-121.

50. Windsor, D. (2001) International Virtual Teams: Opportunities and Issues, in Michael M. Beyerlein, Douglas A. Johnson, Susan T. Beyerlein (ed.) *Virtual teams (Advances in Interdisciplinary Studies of Work Teams, Volume 8)*, Emerald Group Publishing Limited, 1-39.