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Diversity, Internal Environment, Shared Leadership, and Information Sharing in Short-Duration  
Virtual Teams: Findings from a Laboratory Experiment

Fang He  
Enterprise Risk Management  
USAA  
San Antonio, Texas  
St. Louis, MO 64101  
[helen0908@yahoo.com](mailto:helen0908@yahoo.com)

Souren Paul  
College of Engineering and Computing  
Nova Southeastern University  
Fort Lauderdale, Florida  
[Souren.paul@gmail.com](mailto:Souren.paul@gmail.com)

**ABSTRACT**

The purpose of this research is to examine the relationships among diversity, internal environment, shared leadership, and information sharing of short-duration virtual teams engaged in a problem solving task. A laboratory experiment was conducted involving collaboration technology supported virtual teams that were engaged in a task on conceptual data model design. Two forms of team diversity were measured e.g. national cultural and education specialization diversities. We found that educational specialization diversity adversely affected internal environment which in its turn, had a positive relationship with shared leadership in the teams. We also found that shared leadership was positively related to information sharing in the virtual teams.

**KEYWORDS:** Diversity, Shared Leadership, Information Sharing, Trust, Virtual Team

**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 communicate and share information, 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. These arrangements have also been made to facilitate inter-organizational collaborations. In management literature, the virtual teams have been distinguished from virtual groups in the sense that teams have interdependence and shared responsibility among its members and in virtual groups, the members have independent responsibility (Dube and Pare, 2002). Although our research is on virtual teams, we will use the terms virtual teams and virtual work groups interchangeably in this paper. Based on the conceptualization of Powell, Piccoli, and Ives (2004), we define a virtual team as the collection of dispersed individuals brought together by information and telecommunications technologies to accomplish one or more organizational tasks. 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. In this study, we focus on short duration virtual teams and explore the relationships among diversity, internal environment, shared leadership, and information sharing of these teams. Although diversity has been studied extensively in the context of teams and groups, we chose to focus on diversity in team members' national culture because virtual teams usually consist of members from different nations. We also study diversity in team members' educational specialization which is relatively unexplored in information systems (IS) research. Dahlin, Weingart, and Hinds (2005) report the effect of team members' diversity in educational specialization on the range and depth of information use. Prior research has looked into the effects of cultural diversity on the processes and the performance of virtual teams. However, no major study has focused on the effect of educational specialization diversity in these teams. The psychological factors, such as trust, and motivation explain team members' collective perception of the internal environment of virtual work. The perception of the internal work environment shapes the problem solving processes and outcome of the teams. 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 critical when team members belong to different national cultures and have dissimilar educational specializations.

Zigurs (2003) suggests that the members of virtual teams can jointly play leadership roles and shared leadership may emerge in these teams. The team members take turns and provide leadership for tasks for which each individual member has knowledge and skill (Bligh, Pearce, and Kohles, 2006). The issue of shared leadership has been discussed in the context of empowered teams (Pearce and Sims, 2002); complex knowledge works (Pearce, 2004). Although researchers have studied shared leadership of groups and organizations (Pearce and Conger, 2003; Pearce and Sims, 2002), almost none of these studies focus on virtual teams. This paper attempts to address this gap by examining the relationship between team members' perception of its internal environment and shared leadership.

Another distinctive feature of our study is our emphasis on short duration teams. Traditionally researchers tend to study virtual teams that 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 virtual teams play crucial role in emergency response situations and providing temporary support on technical problems. Dube and Pare (2002) suggest that developing trust, cohesion and building relationships are difficult in short duration virtual activities. 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 virtual teams perceive the internal environment, work together, and perform assigned task.

In this paper, we propose and validate a research model (Figure 1) that links national cultural and educational specialization diversities with internal environment, shared leadership, and information sharing of short duration virtual teams. The primary research questions of this study are:

- Do cultural and educational specialization diversities of short-duration virtual team have relationship with team members' perception of its internal environment?
- Does team members' perception of its internal environment have relationship with shared leadership in short-duration virtual teams?
- Does shared leadership facilitate information sharing in short-duration virtual teams?

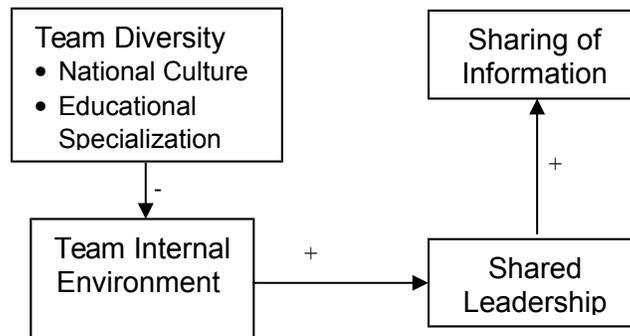
The results of our study indicate that educational specialization diversity affects team members' perception of the internal environment of the virtual teams. We also find that team members' collective perception of its internal environment facilitates the development of shared leadership in the teams. Finally, we find that shared leadership results in information sharing in virtual teams.

In the next section, we 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

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 salient finding from the extant literature on the constructs of this study.

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).

As the members of virtual teams do not usually meet face-to-face, 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). Cultural values influence the perceptual filter through which an individual interprets information needed to make decisions (Hofstede, 1980). Two types of cultural difference may prevail among the members of the virtual teams: difference in national and organizational cultures. In this study, we focus on national cultural diversity in the virtual teams.

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.

Another form of team diversity is functional diversity, which refers to the total number of specialties of team members. Functional diversity 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). Previous research indicated 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). A variation of functional diversity is educational specialization diversity, which "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 specialization 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 specialization) has less distinctive attributes that can be ascribed to a social category. Educational backgrounds shape how an individual processes information. We consider that educational specialization diversity is less constrained than functional diversity and is a fundamental source of team diversity. Moreover, it is an unexplored construct in the research on virtual teams. Thus, we focus on educational specialization diversity in this research.

Next we discuss the relationship of team diversity with group behavior and internal environment of the teams.

### **Diversity and its effect on group behavior**

Diversity has both positive and negative effects on group work. Heterogeneous groups are more creative and more likely to reach high quality decisions than homogeneous groups (McGrath, 1984; McLeod, and Lobel, 1992; Triandis, Hall, and Ewen, 1965). Diversity can increase potential productivity of a group (McGrath, 1984). The people of different cultures bring a variety of perspectives and outlooks to a task. The differences in the perspective offer potential for multicultural teams to perform well (McLead and Lobel, 1992; Watson, Kumar, and Michaelsen, 1993). Diversity also reduces the probability of groupthink (Adler, 1990). However, prior literature reports some negative effects of diversity. 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 et al, 1993).

### **Team Diversity and Internal Environment of virtual teams**

Members of global virtual teams interact with the help of collaborative technology. The technology mediated interactions shape members' perception of the internal environment of the team. Jehn and Mannix (2001) discuss the role of group atmosphere in intra-group conflict. They identify trust, cohesion, openness, and respect as four underlying dimensions of the perception of the group atmosphere. Researchers highlight the importance of trust in the socio-emotional process of the virtual teams (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 which are two fundamental dimensions of the internal environment of the team. Culturally and educationally diverse teams have diversity in processing situational information and may have difficulty in communicating effectively in the team. Communication difficulties in the diverse group can result in reduced attraction and cohesion (Adler, 1990; O'Reilly, Caldwell and Barnett, 1989). Conversely, similarity in beliefs, attitudes, and values contribute to cohesiveness (Yukl, 1981) and heterogeneous groups are generally less cohesive (Adler, 1990; Shaw, 1981). We, therefore, hypothesize:

*H1: In short-duration virtual teams, national cultural diversity will have a negative relationship with its internal environment that consists of motivation and trust.*

*H2: In short-duration virtual teams, educational specialization diversity will have a negative relationship with its internal environment that consists of motivation and trust.*

### **Shared Leadership and Internal Environment of Teams**

“Shared leadership refers to a team property whereby leadership is distributed among team members rather than focused on a single designated leader” (Carson, Tesluk, and Marrone, 2007, page 1217). Various definitions of shared leadership exist in the literature. It is lateral influence among peers in a team (Pearce and Sims, 2000); it is the collective influence of team members on each other (Sivasubramaniam, Murry, Avolio, and Jung, 2002); it is the team process where leadership is carried out by the team as a whole (Ensley, Hmieleski, and Pearce, 2006). All members in these teams perform leadership tasks and can influence and guide others to maximize the potential of the team (Pearce, 2004). In other words, the team, as a whole, undertakes leadership tasks and accepts the responsibility for the work of the group. Shared leadership is an inherent characteristic of virtual teams (Lipnack and Stamps, 1999). Shared leadership cannot emerge unless individual team members are willing to accept others’ influence. This can happen only when team members trust each other (Bligh et al., 2006). The team members will voluntarily engage in shared leadership process and share their skills and knowledge if the members perceive high level of trust in their teams.

Pears (2004) suggest that shared empowering leadership in knowledge work groups involves “self-goal-setting, self-evaluation, self-reward and self-development” (page 54). Bligh et al. (2006) suggest that high levels of commitment to the team’s values and goals are critical for shared leadership in teams. The extant literature on shared leadership, thus, imply that motivated team members who develop self-influence skills and are committed to team’s values and goals are ready to share the leadership roles. Thus,

*H3: In short-duration virtual teams, an internal environment that consists of motivation and trust will be positively related to extent to which leadership is shared within the team.*

### **Shared Leadership and Information Sharing in Virtual Teams**

Information sharing is an important condition for organizational knowledge management (Ruggles, 1998). Sharing and comparing information initiates the active construction of knowledge (Gunawardena, Lowe and Anderson, 1997). When the members of virtual teams share the leadership roles, they help each other in defining and solving the group task. This involves sharing of information.

Shared leadership, which is associated with group interaction style (Balthazard, Waldman, Howell, and Atwater, 2004), can facilitate effective information sharing. Group interaction styles can be either constructive or defensive (Cooke and Szumal, 1993). Defensive members unwilling to accept responsibility or sharing leadership exhibit passive behaviors which emphasizing limited information sharing and lack of questioning. In contrast, constructive members sharing leadership are characterized by a balanced concern for group outcomes and free exchange of information. Thus,

*H4: In short-duration virtual teams, the extent to which leadership is shared within the team will be positively related to information shared among team members.*

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## RESEARCH METHODOLOGY

### 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. As all participants of this study had taken courses on database management and application, a data model (Entity Relationship Diagram) design task was chosen. Students of diverse educational background and nationality participated in the meeting. Each participant was provided with one page of introduction paper which listed four pieces 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) used similar 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 two independent variables (national cultural and educational specialization diversities), and three dependent variables (internal environment of the team, shared leadership, and shared information). We collected the demographic data of each participant, which was used to calculate national cultural and educational specialization diversities of the teams. The participants indicated their nationalities and areas of specialization (i.e. majors). Each nationality was considered as a category of national culture. Similarly, 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 educational specialization diversities. The index is:

$$\text{Diversity} = \sum -P_i \ln(P_i),$$

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.

Internal environment of the team was measured using 5-point Likert scale questionnaires that included items on trust and motivation. Four items developed by McAllister (1995) were used to measure trust. Motivation was measured by 4 items (table 1).

In order to measure shared leadership, we measured each member's leadership capability by using a peer review evaluation (table 1). We followed the method used by Lord and Alliger (1985) to derive measurements of leadership perceptions from the questionnaire in which each member's leadership capability was rated by the peers the same team. Individual member's leadership skills were, then, measured by taking the average of the scores received on the four items of leadership. The mean deviation of three leadership scores was used as a measure of the shared leadership of a team.

Information sharing was measured by using parsing rules adapted from Connolly, Jessup, and Valacich (1990) (see Appendix I). Based on a review of parsing rules, a graduate student who was unaware of the details of our research, counted each piece of information shared by members. The total number of process information, task information in distribution and explanation served as our measure of information sharing in the team.

**Table 1. Summary of Measurement Scales**

<p><u>Internal Environment</u></p> <p><i>Trust:</i></p> <ol style="list-style-type: none"> <li>1. We can freely share our ideas, feelings, and hopes.</li> <li>2. If I shared my problems with my members, I know they would respond constructively and caringly.</li> <li>3. My members approached their jobs with professionalism and dedication.</li> <li>4. I can rely on my members not to make my job more difficult by careless work.</li> </ol> <p><i>Motivation:</i></p> <ol style="list-style-type: none"> <li>1. I was motivated to perform better in the teamwork.</li> <li>2. I feel enthusiasm about the teamwork.</li> <li>3. As a team, we tried our best to do the work.</li> <li>4. The more effort we put into the project, the more we gained from the teamwork.</li> </ol> <p><u>Leadership</u></p> <ol style="list-style-type: none"> <li>1. ___ exhibited high level of leadership</li> <li>2. I would like to choose ___ as the formal leader on a similar project.</li> <li>3. ___ exerted control over group activities.</li> <li>4. ___ exerted influence over other group members.</li> </ol> <p style="text-align: center;">Scale: 1 (Strongly disagree) to 5 (Strongly agree)</p>
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**Experimental procedures**

Members in each group were assigned to laptop workstations in three different rooms. The team members could not see each other and did not know who was participating in the meeting. Each member was given log in identification and password that was used to access the meeting

session. The interactions were anonymous. One of the researchers monitored the group work from a separate room. The major activities of the experiment were: (1) Team members participated in a discussion and distributed several pieces of information on hand. (2) Team members selected one from within the team to draw the ERD (referred to as Drawer). The drawing process was observable by other members at same time. The other members could not directly modify the diagram but had to ask the drawer to do so. (3) Once the team finished the ERD, the team members completed a posttest questionnaire that collected demographic data and psychological factors. Figure 2 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.

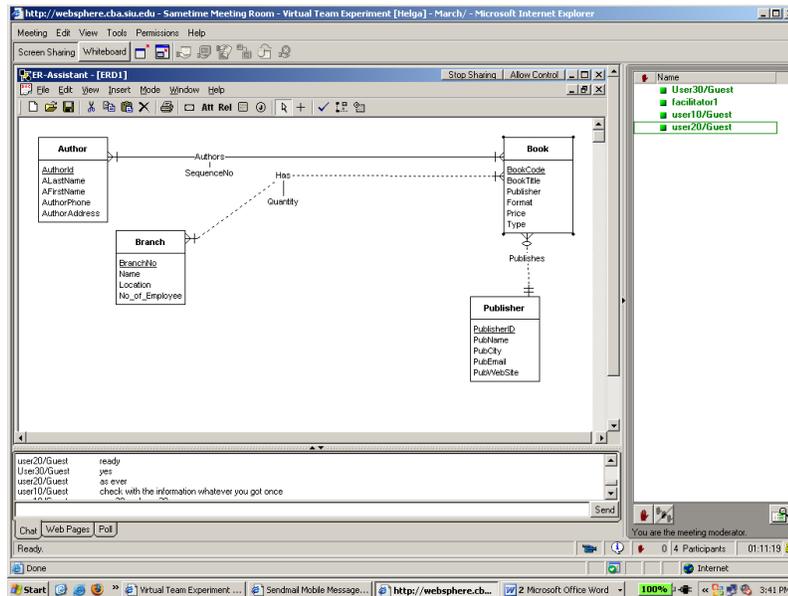


Figure 2. Participants Developing ER Diagram

**RESULTS**

**Reliability and validity**

Nunnally (1978) suggests that a reliability of a construct between 0.60 and 0.80 should be acceptable. Thus, we consider an alpha value of 0.70 as the cut-off value. Fornell and Larcker (1981) propose that the average variance extracted from a construct should exceed 0.50. As Table 2 indicates, the reliability and validity requirements were satisfied for the measures of internal environment and leadership.

Constructs	Construct reliability <sup>a</sup>	Factor Loadings
Internal Environment	0.868	0.724-0.830
Leadership	0.833	0.793-0.850

a. Construct reliability is estimated using Cronbach’s  $\alpha$  coefficient.

b. Two items measuring trust (items 1 and 4) were dropped after the initial factor analyses.

### 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 tested hypotheses 1 and 2 by regressing the internal environment on national cultural and educational specialization diversity indices. Based on the results presented in table 3, internal environment that consist of trust and motivation was found to be positively related to educational diversity but not to national cultural diversity.

Independent Variables	Internal Environment
Intercept	4.885****
National Cultural Diversity	-0.029
Educational specialization Diversity	-0.426**
R-Square	0.383
F	6.21
Prob. (F)	0.008
Hypotheses Supported?	H1: No; H2: Yes
* p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001	

Next, we tested hypotheses 3 by regressing the shared leadership on internal environment. The results are shown in table 4. We found that internal environment that consists of trust and motivation was positively related to shared leadership in the team.

Finally, we tested hypothesis 4 by regressing the total number of information shared on shared leadership. The result (table 5) implies that shared leadership has a significant positive relationship with information shared in a group. Thus, we found support for hypothesis 4.

Independent Variables	Shared Leadership
Intercept	2.467**
Internal Environment	-0.429**
R-Square	0.293
F	8.70
Prob. (F)	0.0077
Hypotheses Supported?	H3: Yes
* p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001	

<b>Independent Variables</b>	<b>Sharing of Information</b>
Intercept	159.504****
Mean deviation of leadership scores	-80.613*
R-Square	0.208
F	5.52
Prob. (F)	0.029
Hypotheses Supported?	H4: Yes
* p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001	

## DISCUSSION

Based on the findings of our study, we suggest that in short-duration virtual teams, educational specialization diversity is an important predictor of trust and motivation of the team members. When team members have different educational specializations, their processing of situational information can be different. They can comprehend situational cues differently which may hinder the development of situational trust in these teams (Panteli, 2003).

We did not find any effect of national cultural diversity in our study. This might have happened because of the task that the participants had to perform in the experiment. Data model design is a problem solving task. As group members worked on the data model design problem, they exchanged task related information. Sharing of task related information was not influenced by individual member's cultural beliefs and norms. We might have found a significant relationship with of national cultural diversity had we engaged the subjects in a decision making or cognitive conflict task.

We found that internal environment that consists of trust and motivation, promotes shared leadership in a virtual teams. Carson, Tesluk, and Marrone's (2007) highlighted the importance of internal environment of teams in facilitating shared leadership. Our operationalization of the internal environment was based on trust and motivation which are two fundamental aspects of team empowerment.

Another interesting finding of our study is the positive relationship between shared leadership and information sharing in virtual teams. This lends support to the proposition that shared leadership is positively related to knowledge creation (Bligh, Pearce, and Kohles, 2006).

## Limitations

The participants in this study were 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. The effects of diversity on internal environment may 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 long duration virtual teams is an important research question that may be pursued in future.

### Implications for Managers

By encouraging virtual team members to share leadership roles, it will be possible to facilitate information sharing in the teams. Information sharing leads to creation of knowledge. However, the development of shared leadership in global virtual teams is a challenging task. These teams include members from diverse national cultures and educational specializations. As found in our study, a positive internal environment that is based on trust and motivation empowers the virtual teams and facilitates the development of shared leadership. In order to improve the sharing of information and knowledge in virtual teams, the managers should promote trust and motivation among the team members.

### CONCLUSIONS

Although this study marks the beginning of research short duration virtual teams, we can draw some conclusions from this research. We found that educational specialization diversity is an important construct and it hinders the development of favorable internal environment in short duration virtual teams. The critical issue is the proper management of educational specialization diversity in virtual teams. Managers of virtual teams may organize training and orientation session before engaging individual members in the project. We also found that the development shared leadership is beneficial for virtual teams. However, shared leadership is intricately associated with the development of a positive internal environment of the teams. In short, the findings of our study highlight some challenges in the management of virtual teams.

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**Appendix I**  
**A coding system for message classification**

[Adapted from Connolly et al. (1990)]

**Parsing rules for message coding:**

1. Text continuing should be coded as one unit.
2. Assign text into first category which shows a good fit (i.e., first try to assign as PI; if this fails, try as TI-D; etc.)

<b>Categories</b>	<b>Description</b>
<b>PI</b>	Any text not covered in the introduction paper but related to the project is counted as process information, e.g., "You can write two labels on the line showing cardinality if you want".
<b>TI-D</b>	Any text covered in the introduction paper is counted as task information. Any new task information covered in the introduction paper is coded as distributed information, e.g., "I have information about authors, which will be an entity".
<b>TI-E</b>	Any old task information covered in the introduction paper is coded as explained information, e.g., "From book to publisher, I think the relationship is backward, the mandatory one should be on the other side". For any old information, supportive statement (e.g., "You are right. It's a weak entity"), confirmation (e.g., "That's an easy enough relationship"), critical argument (e.g., "Branch number shouldn't be added with book entity"), query statement (e.g., "sequence or sequence_no?") are coded as explained information.
<b>OTT</b>	Text that are not related to the project and do not fit into the existing categories, e.g., "I didn't have breakfast".
<b>UC</b>	Uncodable text.