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# Importance of Diversified Leadership Roles in Improving Team Effectiveness in a Virtual Collaboration Learning Environment

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## ABSTRACT

Virtual teams enabled by information and communications technologies (ICT) are increasingly being adopted not only by for-profit organizations but also by education institutions as well. This study investigates what contribute to the success of virtual learning teams in a higher-education institution. Specifically, we examine the issue of leadership in virtual learning teams. The study first reviews the current literature on teams, leadership, and trust then proposes a framework of team effectiveness of online learning teams. A field study is conducted to investigate the influence of several independent variables including diversified leadership roles, leadership effectiveness, team trust, and propensity to trust. It is found that diversified leadership roles influences both leadership effectiveness and team trust; both leadership effectiveness and propensity to trust influence team trust, and team trust in turn directly impacts team effectiveness. In addition, team trust mediates the relationship between leadership effectiveness and team effectiveness. Some practical implications of the results are discussed as well.

## Keywords

Virtual team; Leadership; E-learning; Groupware; Leadership roles; Computer-supported cooperative work

## INTRODUCTION

Advancements in information and communication technologies (ICT), specifically the use of Internet-based systems, have allowed people the ability to work and learn remotely and virtually while retaining or superseding the performance of traditional teams. Virtual teams differ from F2F teams primarily through virtual teams' heavy reliance on ICT as media for communication and as a connection between people (Lipnack and Stamps, 1997). In addition, many issues, such as team roles, leadership, power, trust (Greiner and Metes, 1995), culture, time and distance, and organizational relationship building in virtual teams, are emerging and have not been readily addressed (Pauleen and Yoong, 2001). In effect, "when teams are dispersed, it's easier to lose sight of the purpose and the goal." (Henry and Hartzler, 1998, p. 24)

ICT links used by virtual teams can be synchronous or asynchronous tools used to carry out interpersonal communications, collaboration and coordination (O'Hara-Devereaux and Johansen, 1994). Synchronous ICT tools vary in terms of social presence and information richness and can be classified as text, audio and video-based conferencing systems. Asynchronous ICT tools range from e-mails, discussion forums, and bulletin boards, to workflow, scheduling and other project management applications.

In addition to effective ICT links, a strong leadership is needed for the success of virtual teams (as in F2F teams). It is commonly agreed upon that strong leadership is hard to establish in a virtual environment. Shared or distributed leadership among team members are more likely to achieve team success (Lipnack and Stamps, 1997). This means that team members need to have self-directing freedom to manage their team project in a collaborative fashion (Barry, 1991). Furthermore, to

improve team performance a team leader also needs to consider internal group dynamics and external supporting mechanisms (Lurey and Raisinghani, 2001). ICT-enabled communication tools are vehicles that can improve the effectiveness of internal and external supporting mechanisms.

The purpose of this study is to examine the antecedents to the effectiveness of virtual learning teams. We carry out a field study to investigate the influence of several independent variables and deliberately engage team members to interact with each other via a wide variety of ICT media. Controlling the virtual environment allows us to focus our attention on some key elements: leadership effectiveness, team trust, propensity to trust, and team effectiveness.

## **THEORETICAL MODEL**

### **Leadership Roles in the Virtual Team**

The behavioral complexity theory of leadership stresses the importance of a leader exhibiting diversified leadership roles in order to improve team effectiveness (Kayworth and Leidner, 2002). A leader also needs to be a change agent. Schein (1992) defines leadership as “the ability to step outside the culture to start evolutionary change processes that are more adaptive.” (p. 2) Kotter (1982) asserts that leadership is different from management and needs to particularly address issues of change, inspiration, motivation, and influence.

Other researchers combine the abovementioned leadership roles based on the complexity of environment (Jessup, 1990). Mintzberg (1973) asserts that a manager alternates among leadership roles swiftly to cope with daily challenges. Leaders in the prevalent virtual teams are facing new challenges, such as ICT-enabled communications, cross-cultural communications, global logistical design, technological complexity (Kayworth and Leidner, 2002), information overload, lack of social cues (Hallowell, 1999), and fast creation of camaraderie (Johnson, 2000). In a virtual setting, the need for an effective leader to recognize differences among team members is even greater than that in F2F settings. This study capitalizes on the leadership complexity theory and posits that an effective leader in the virtual learning team also needs to assume diversified leadership roles in order to achieve success in project performance.

### **Predictors of leadership effectiveness**

Quinn’s (1984) Model of Leadership Roles places eight leadership roles along two dimensions—stability vs. flexibility and internal focus vs. external focus—in order to explain the opposing behaviors of an effective leader. An effective leader needs to recognize the roles of his or her behaviors and play competing leadership roles delicately in order to deal with the complexity of the real world (Quinn 1984; Hart and Quinn 1993; Hooijberg 1996).

Effective leaders in the virtual learning collaboration environment exercise the leadership roles in the internal-stable and external-stable quadrants of Quinn’s (1984) model. What is unclear to us is what effects on the learning outcomes can these leadership roles—producer, director, monitor and coordinator—have? Furthermore, although leadership roles with the emphasis of flexibility seem to be less important in the e-learning context, their impacts on team learning outcomes need further assessment. This research seeks to understand the efficacy of diversified leadership roles on leadership effectiveness in the virtual learning collaboration environment.

*H1: A leader has higher leadership effectiveness when exhibiting diversified leadership roles.*

### **Dynamics of Trust in Virtual Teams**

Trust is a multi-faceted factor that has been studied in the fields of organizational science (Kramer and Tyler, 1996; Gambetta, 1998), sociology (Coleman, 1990), economics (Fukuyama, 1995), social psychology, and marketing management (Rousseau, Sitkin, Burt, and Camerer, 1998). Social exchange theory deals with the interpersonal exchange of intangible social costs and benefits (Kelley and Thibaut, 1978). Team members need to have the strong belief—trust—at the outset of team formation in order to facilitate the social exchange process. Team trust is a function of perceived ability, integrity, and benevolence as well as the propensity of members to trust each other in the virtual team (Jarvenpaa, Knoll, and Leidner, 1998). The social perspective takes into consideration affective, cognitive, and behavioral factors. An increase of physical and psychological distance among team members (O’Hara-Devereaux and Johansen, 1994) and the necessity of building trust at the outset of virtual team formation further substantiate the importance of trust issues in virtual teams.

### **Leadership and Team Trust**

To be an effective leader and to effect actions, a leader needs to articulate visions clearly, embody values and create the environment to accomplish things together with team members. Drath and Palus (1994) concur with this assertion by defining leadership as “the process of making sense of what people are doing together so that people will understand and be committed.” (p. 4) However, Denison, Hooijberg, and Quinn (1995) state that a leader still needs to “...exhibit contrary or opposing behaviors (as appropriate as necessary) while still retaining some measure of integrity, credibility, and direction.” (p. 526) In other words, in a virtual environment a leader still needs to play diversified leadership roles, have the interpersonal skills to harmonize relationships, exhibit roles of facilitator and mentor to help improve communication and solidify relationships among team members, and shift to producer-like roles when project deadline nears.

*H2: Trust among team members can be improved when a leader exhibits diversified leadership roles.*

However, in a virtual team situation, the leader relies extensively on ICT to communicate with members and to disseminate information, and a leader’s dependence on ICT as a primary communication means could weaken his or her ability as a leader in a virtual team (Avolio and Kahai, 2003). Furthermore, positive leadership can quickly build trust and continuously maintain trust relationships (Jarvenpaa, Knoll, and Leidner, 1998; Jarvenpaa and Leidner, 1999).

*H3: Leadership effectiveness established by a leader can improve trust among team members.*

### **Team Trust and Team Effectiveness**

Jarvenpaa and Leidner (1999) assert that to succeed in virtual teams, a higher level of trust needs to be established in the beginning and ending periods of a project. Affective elements such as trust are more important than cognitive elements in a fragile environment like virtual teams (Meyerson, Weick, and Kramer, 1996). An effective surrogate of measuring team effectiveness is a team’s learning performance and satisfaction. The performance indicator is concerned with the percentage of goals achieved while the attitudinal indicator is concerned with team relationships (Gladstein, 1984; Lurey and Raisinghani, 2001). Lipnack and Stamps (1997) found that trust is the prerequisite to the success of virtual teams. Building upon prior literature, this study adopts both performance and attitudinal indicators to assess team effectiveness. Thus,

*H4a: Higher trust among team members can lead to higher team performance of team members.*

*H4b: Higher trust among team members can lead to higher team satisfaction of team members.*

Note that as a consequence of H3 and H4, team trust becomes structurally a mediating variable between leadership effectiveness and team effectiveness (see Figure 1). In other words, the relationship between leadership effectiveness and team effectiveness is then a function of team trust. The mediating role of team trust makes sense conceptually because it is widely agreed that when a leader is effective, he or she will have lasting impacts on members and cause them to take actions to achieve the team’s goals (Bass, 1981); but if team members do not trust each other, then it is difficult for a leader to exert influence on team success regardless of how effective the leader is. Thus,

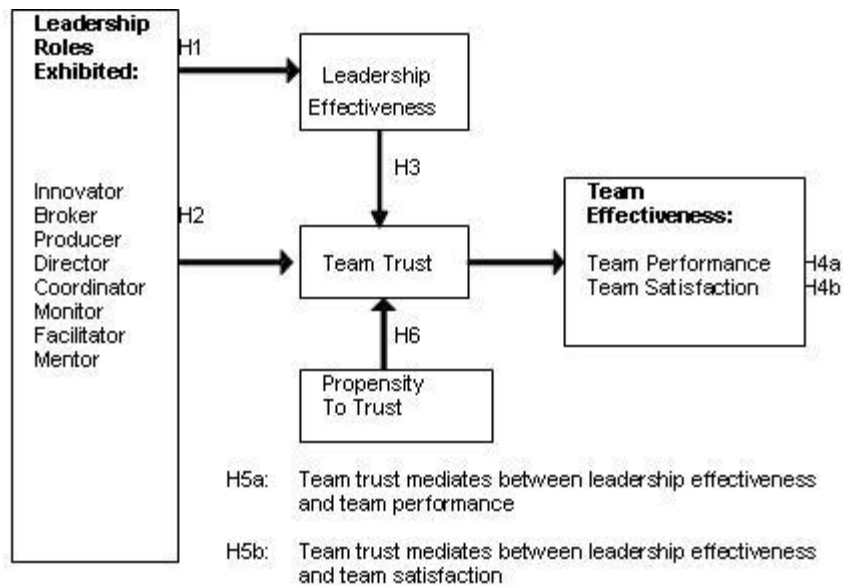
*H5a: Team trust mediates the relationship between leadership effectiveness and team performance of team members.*

*H5b: Team trust mediates the relationship between leadership effectiveness and team satisfaction of team members.*

### **Propensity to Trust and Team Trust**

Cattell (1994) defines personal orientation as persistent reflection orientation, the fundamental unit of personality. Propensity to trust or disposition to trust is a persistent reflection orientation or personality. When an individual has a strong belief in human nature (high trust orientation), he or she will selectively choose information that is consistent with trust orientation and interpret this information accordingly (McKnight, Cummings, and Chervany, 1998). Individuals with high trust orientation or propensity to trust can naturally have a higher trust in team, team members and its leader.

*H6: The higher propensity of team members to trust each other, the higher trust among team members.*



## RESEARCH METHODOLOGY

### Procedure

To investigate the proposed theoretical model, we conducted a field study (Cook and Campbell, 1979) to collect data and to test the hypotheses in the context of an online course. The subjects consisted of 164 undergraduate students who enrolled in an online management of information systems (MIS) course at a private university in Taiwan. The subjects were randomly assigned to 14 virtual learning teams, each team consisting of between 12 to 13 members. After each team elected a team leader, all the members worked with each other on a case project over a period of six weeks with a final report due as the deliverable. The operational schedule is shown in Table 1.

### ICT Media

To support the members' team-based learning activities and to facilitate their communication process, the instructor made available to students four types of ICT media: Microsoft Network (MSN) messenger, e-mail, online meeting room, and chat room. Each team and its members can use these four media in anyway as they see fit.

The course e-learning system captured the usage information of the meeting rooms and the chat rooms. The instructor could use the course e-learning system to monitor team activities and stop malicious behaviors if necessary.

### Measurement

The investigation of the theoretical model requires the measurements of six variables. The construct of leadership roles is measured using the instrument of Denison, Hooijberg, and Quinn (1995). This measure consists of eight dimensions, each measuring one of the eight roles exhibited by a leader. Leadership effectiveness is measured using the instrument of Kayworth and Leidner (2002) which does an assessment along three dimensions of their leaders' effectiveness: performance, managerial success, and overall managerial effectiveness. Propensity to trust is measured using the instrument developed by Saoee, Valacich, and Suprateek (2003) while team trust is measured using the instrument in the Jarvenpaa and Leidner (1999) study.

Team satisfaction is measured by using Tjosvod's (1998) instrument which determines the subjects' emotions and their assessment of future potential of their virtual team. Team performance is measured by how the teams performed on their case reports. To increase reliability, the teaching assistant graded the case reports first, and the instructor graded the reports again and assigned final grades. Grades were given based on three criteria: rigor, creativity, and presentation.

## RESULTS

## Descriptive Statistics

The 164 students in the online course were asked to take the online survey. A total of 132 surveys were collected, giving a response rate of 80.5%. The seventh question of the survey (measuring team trust) was deliberately constructed in reverse order to screen out invalid responses. 19 responses were eliminated. The number of valid returns is then 113 giving a valid response rate of 68.9%. All 14 teams have response rates higher than 50%.

Table 1 shows the Cronbach's alphas for all major variables. As can be seen in the table, all variables have reasonably good reliability with Cronbach's alpha higher than 0.7. In terms of the final dependent variables, the 14 case reports submitted have a mean of 76.4 and a standard deviation of 8.2, and team satisfaction has a mean of 3.86 and a standard deviation of 0.27. Team performances (grades of team reports) of six teams are greater than the overall mean, while team satisfactions of seven teams are greater than the overall mean of all subjects. All in all, five teams have team performances and team satisfactions that are both above the overall means.

For the various leadership roles, the Pearson's correlation coefficients (*r-values*) range from 0.604 ( $p < .05$ ) to 0.941 ( $p < .01$ ) showing medium to high correlations among the various measured leadership roles. In addition, all seven leadership roles exhibit significant, positive relationships with leadership effectiveness as shown by *r-values* ranging from 0.621 ( $p < .05$ ) to 0.913 ( $p < .01$ ), as well as significant, positive relationships with team trust (*r-values* ranging from 0.584,  $p < .05$  to 0.761,  $p < .01$ ). In terms of the final dependent variables, there are significant and positive relationships between team performance and team trust (*r-value* = 0.773,  $p < .01$ ), as well as between team satisfaction and team trust (*r-value* = 0.854,  $p < .001$ ); however, there is no significant relationship between the two dependent variables of team performance and team satisfaction (*r-value* = 0.527, not significant).

## Model Testing

A regression analysis was adopted to test the operational model (Table 2). The results show leadership roles have significant explanatory powers of variances in leadership effectiveness as well as in team trust. Thus, hypotheses H1 and H2 are supported. The tests show that both leadership effectiveness and propensity to trust have significant explanatory powers of variance in team trust, thus hypotheses H3 and H6 are supported. The test results show that team trust does have significant explanatory powers of variances in both team performance and team satisfaction, especially in team satisfaction. Thus, hypotheses H4a and H4b are supported. To test whether or not team trust mediates the relationship between leadership effectiveness and team performance (H5a) and between leadership effectiveness and team satisfaction (H5b), we employ the conditions stated by Baron and Kenny (1986) and use stepwise regression.

To satisfy these conditions, we look at some of the results found earlier and the stepwise regression. With H3, H4a, and H4b being supported earlier, leadership effectiveness exerts significant influence on team trust and this team trust exerts a significant influence on team effectiveness. The regression results indicated that leadership effectiveness exerts significant influence on both team performance and team satisfaction, while for the variable team trust, the relationships between leadership effectiveness and team performance and between leadership effectiveness and team satisfaction are no longer significant. These results lead to H5a and H5b being supported. An entire summary of hypothesis testing can be found in Table 3.

## DISCUSSION

This study shows that a higher degree of diversified roles exhibited by a leader can help improve leadership effectiveness. This result is consistent with prior studies (Mintzberg, 1973; Jessup, 1990; Denison, Hooijberg, and Quinn, 1995). Whereas these prior studies focus on teams in organizations, our study confirms the existence of the same relationship in a virtual collaborative learning environment. More specifically, positive relationships exist for all seven leadership roles measured, demonstrating that it is important for a leader in a virtual environment to exhibit diversified leadership roles as needs arise.

A positive relationship also exists between leadership roles and team trust. Teammates effectively create trust as a psychological contract by expecting reciprocal obligations between each other (Rousseau, 2001). The degree of significance is greater in leadership effectiveness as it relates to leaderships roles compared to trust. It may be explained by the nature of the study and the difficulty to build trust in such a short amount of time in a virtual environment.

In addition, team trust is found to be positively correlated with team performance and team satisfaction, two proxies of overall team effectiveness. These results are robust because the two dependent variables (i.e., team performance and team

satisfaction) exhibit insignificant correlations with each other, demonstrating that the effects exhibited by team trust are separate and noteworthy. The study demonstrates that team trust plays a mediating role between leadership effectiveness and team performance, as well as between leadership effectiveness and team satisfaction. This result makes sense because if team members do not trust each other, then regardless how effective the leader is, team performance and satisfaction would suffer.

The positive relationship found in this study between propensity to trust and team trust is also supported by Jarvenpaa, Knoll, and Leidner (1998). Because personality traits and cultural backgrounds can influence one's disposition or propensity to trust others (Mayer, Davis, and Schoorman, 1995), the evidence gathered of the relationship is especially strong as we controlled for this by randomly assigning students to virtual learning teams without regard to their social backgrounds.

There are some important limitations of this research study. The generalizability of the field study is low and can currently only be applied to MIS undergraduate class doing a small group case analysis. In addition, the field study was done over a period of six weeks in an uncontrolled outside setting the class environment where other communication influences are difficult to control. There may have been some bias in measuring the performance since the names of the students were known to the graders during evaluation process. Despite the limitations mentioned above, there are nevertheless some practical implications as a result of this study. Given that this research has demonstrated the importance of leadership roles, one may want to use a questionnaire to assess candidate leaders' leadership roles and traits prior to deciding on a virtual team leader. To ensure high team performance and satisfaction, one may consider installing a leader that has been proven effective in previous engagements (via other instructors' feedback or other evidence).

Moreover, this study has shown that team trust is not only a predictor of both team performance and team satisfaction, but also a mediating variable that affects the relationship between leadership effectiveness and team effectiveness. Thus trust is a very important variable to the success of a virtual learning team. Since team trust plays such a crucial role in the overall team success, it may make sense to include in a team as many members as possible who have high propensity to trust (selected using a pretest questionnaire).

## CONCLUSION

Many higher-education institutions around the world are increasingly relying on the online learning model to deliver education to students who otherwise cannot or would not physically attend. This study examines the effect of different predictor variables on two variables of effectiveness of virtual learning teams: team performance and team satisfaction. Specifically, the diversified roles played by learning team leaders and leadership effectiveness, as well as team trust and propensity to trust, are examined. The results of this study show that diversified leadership roles, leadership effectiveness, and team trust are all important in contributing to team effectiveness in a virtual learning environment. In addition, team trust is found to be a significant variable that mediates the effect transmitted from leadership effectiveness to team performance, as well as from leadership effectiveness to team satisfaction.

Construct	Cronbach's alpha	Variables	# of Questions
Leadership Roles	0.96	Innovator	2
		Producer	2
		Director	2
		Collaborator	2
		Monitor	2
		Facilitator	2
		Mentor	2
Leadership Effectiveness	0.95	Leadership Effectiveness	5
Team Trust	0.91	Team	8
Team Satisfaction	0.90	Team Satisfaction	3
Individual Propensity to Trust	0.78	Individual Propensity to Trust	4
<b>Table 1. Reliability of Instruments Used</b>			

Predictors	Dependent Variables	
	Leadership Effectiveness	Leadership Effectiveness
Diversified Leadership Roles	.843*** R <sup>2</sup> = .710 F-value = 29.387***	.684** R <sup>2</sup> = .467 F-value = 10.522**
Leadership Effectiveness	-	.672** R <sup>2</sup> = .451 F-value = 9.885**
Propensity To Trust	-	.704** R <sup>2</sup> = .495 F-value = 11.784**
	Team Performance	Team Satisfaction
Team Trust	.773** R <sup>2</sup> = .597 F-value = 17.779**	.854*** R <sup>2</sup> = .729 F-value = 32.294***
	Team Performance	Team Satisfaction
Leadership Effectiveness (without Team Trust)	.614* R <sup>2</sup> = .377 F-value = 7.254*	.647* R <sup>2</sup> = .418 F-value = 8.625*
Leadership Effectiveness (with Team Trust)	.172	.133

Table 2. Regression and Stepwise Regression Analysis

Note: \* p<.05; \*\* p<.01; \*\*\* p<.001

Hypothesis	Results		
	Supported?	R <sup>2</sup>	F-value
H1: A leader has higher leadership effectiveness when exhibiting diversified leadership roles	Yes	0.71	29.387***
H2: Trust among team members in the virtual learning collaboration environment can be improved when a leader exhibit diversified leadership roles	Yes	0.467	10.522**
H3: Leadership effectiveness established by a leader can improve trust among team members in the virtual learning collaboration environment	Yes	0.451	9.885**
H4a: Higher trust among team members can lead to higher learning performance of team members	Yes	0.597	17.779**
H4b: Higher trust among team members can lead to higher learning satisfaction of team members	Yes	0.729	32.294***
H5a: Team trust mediates the relationship between leadership effectiveness and learning performance of team members	Yes	See Table 3	
H5b: Team trust mediates the relationship between leadership effectiveness and learning satisfaction of team members	Yes	See Table 3	
H6: The higher propensity of team members to trust each other, the higher trust among team members	Yes	0.495	11.784**

Table 3. Summary of Hypothesis Testing

Note: \* p<.05; \*\* p<.01; \*\*\* p<.001



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