
Leadership Effectiveness in Global Virtual Teams

TIMOTHY R. KAYWORTH AND DOROTHY E. LEIDNER

TIM KAYWORTH is an Assistant Professor of Management Information Systems in the College of Business at Baylor University. He has prior industry experience in information systems consulting and has also held positions as director of management information systems and operations manager for private sector firms. Professor Kayworth's current research interest centers on the management of information technology in organizations and the effects of information technology (IT) infrastructure and its development within organizations. He has conducted field-based research addressing the use and effectiveness of corporate IT standards in contemporary firms. Professor Kayworth's work has been published in the proceedings of the *International Conference on Information Systems (ICIS)*, *European Management Journal*, and *Journal of Information Technology Management*, as well as in numerous conference proceedings.

DOROTHY E. LEIDNER is an Associate Professor of eBusiness at Texas Christian University in Ft. Worth, Texas. She is on leave of absence from INSEAD in Fontainebleau, France. Dr. Leidner received her Ph.D. in Information Systems from the University of Texas at Austin, from where she also obtained her MBA and BA. She has been on the faculty at Baylor University and has been a visiting professor at the Instituto Tecnológico y des Estudios Superiores de Monterrey, Mexico, at the Institut d'Administration des Entreprises at the Université de Caen, France, and at Southern Methodist University in Dallas, Texas. Dr. Leidner has published her research in many journals, including *MIS Quarterly*, *Journal of Management Information Systems*, *Information Systems Research*, and *Organization Science*. She received best paper awards in 1993 from the Hawaii International Conference on System Sciences, in 1995 from *MIS Quarterly*, and in 1999 from the Academy of Management.

ABSTRACT: The trend toward physically dispersed work groups has necessitated a fresh inquiry into the role and nature of team leadership in virtual settings. To accomplish this, we assembled thirteen culturally diverse global teams from locations in Europe, Mexico, and the United States, assigning each team a project leader and task to complete. The findings suggest that effective team leaders demonstrate the capability to deal with paradox and contradiction by performing multiple leadership roles simultaneously (behavioral complexity). Specifically, we discovered that highly effective virtual team leaders act in a mentoring role and exhibit a high degree of understanding (empathy) toward other team members. At the same time, effective leaders are also able to assert their authority without being perceived as overbearing or inflexible. Finally, effective leaders are found to be extremely effective at providing regular, detailed, and prompt communication with their peers and in articulating role relationships (responsibilities) among the virtual team members. This study provides useful insights for managers interested in developing global virtual teams, as well as for academics interested in pursuing virtual team research.

KEY WORDS AND PHRASES: collaboration technology, computer-mediated communication systems, computer-supported cooperative work, global virtual teams, virtual teams.

ALTHOUGH THE UNDERLYING CONCEPTS of team-based work groups remain relatively stable [45], certain business drivers have begun to alter the nature of teams, as well as the ways they accomplish work. The growing popularity of interorganizational alliances (such as Microsoft and Intel), combined with a growing tendency to flatter organizational structures and globalization, has accelerated the need for firms to coordinate activities that span geographical, as well as organizational boundaries [49]. In addition, the shift from production to service-related businesses has spawned a new generation of knowledge worker not bound to physical work locations. These factors suggest that firms are faced with increased challenges to coordinate tasks across time zones, physical boundaries, and organizational contexts. Consequently, the virtual team has begun to emerge as a new form of structure, supported by enabling information and communication technologies, able to meet the challenges of this new work context. Townsend et al. [49] describe this emergent structure: "Virtual teams are composed of coworkers geographically and organizationally linked through telecommunications and information technologies attempting to achieve an organizational task" (p. 17).

Evidence of this trend has been found in a variety of work contexts, such as the use of physically dispersed teams in software development environments [16]. In one study [16], researchers have proposed an organizational framework for the deployment of virtual teams in cooperative software engineering projects.

The use of virtual teams poses significant challenges for organizations wishing to deploy them. Although many of these challenges are present in traditional teams, they may become even more pronounced in virtual settings [45]. One such challenge has to do with team leadership. Existing studies of distributed (such as, virtual) groups linked together through computer-mediated communication systems (CMCS) suggest that team leadership in these settings is vitally important [24, 25, 26]. In their exhaustive review of GSS experimental literature, Fjermestad and Hiltz [11] also note the importance of team leadership: "Among the key variables that have been observed to influence the effectiveness of small-group decision making are leadership and structuring of the group process" (p. 7). These arguments suggest that the study of virtual team leadership is both a timely and relevant topic of research.

Although there is an abundance of theories and empirical studies to explain leadership effectiveness in traditional team settings [2, 17], little empirical work exists that examines leadership in virtual team settings. Consequently, the focus of this work will be to address this gap through investigating leadership effectiveness in a virtual team environment. The following research questions summarize this effort: *What factors contribute to effective leadership in virtual team environments?* An underlying

premise of this research is that virtual team leaders face a fundamentally different (and more complex) work environment than their traditional team counterparts [49]. Consequently, the set of roles necessary for effective leadership in virtual team settings may be significantly different than those expected in traditional settings [30]. The following section discusses some of these inherent complexities in the virtual environment. Following this, current leadership theory is developed as a means to predict those leadership styles thought to be most effective in the virtual team context. This section is followed by a discussion of the research methodology and the instrumentation used to investigate our research question. Subsequent sections present and discuss the research findings, and provide a summary of conclusions, limitations, and implications for future research.

Theoretical Foundation

The Challenge of Global Virtual Team Environments

WHEREAS GLOBAL VIRTUAL TEAMS undoubtedly face similar challenges as traditional teams, we argue that these dispersed work groups may also face unique issues. This stems from the belief that the CMCS (such as, desktop video conferencing systems, e-mail, group support systems, internets, and intranets) used to link team members across time, space, and organizational boundaries represent fundamentally new types of mediums “with their own advantages, disadvantages, social dynamics, problems, and opportunities” [25, p. 680]. In spite of the efficacy of these innovative technologies, they may present a host of problems not typically found in face-to-face group settings (see Table 1).

Since communication media may differ in their ability to convey “social presence,” information-rich nonverbal cues, such as facial expressions, voice inflections, and gestures, may be lost or distorted through CMCS that lack the social presence inherent to face-to-face environments [37, 52]. The severity of this information loss will be determined by the richness of the technology being used.

Moreover, important social/contextual information, such as member’s social status or level of expertise, may be lost or distorted in virtual team environments characterized by high levels of anonymity [9]. Also, the ability to develop relational links among team members may be hindered, which may negatively affect such outcomes as creativity, morale, decision-making quality, and process loss [51]. Finally, the lack of a social context may alter or hinder the process through which team members develop trust [33]. As a result, virtual team communication through CMCS may appear out of context and without focus [52], resulting in lost meanings, distortion, and misinterpretation of information.

Although new and innovative modes of communication may be possible through CMCS-enabled work groups [1], research suggests that virtual groups may still encounter significant problems in processing communication traffic among team members [21, 22, 40, 52]. In this asynchronous environment, characterized by nonlinear, multi-threaded topics, team members may experience information overload as they

Table 1. Challenges of Virtual Teams

Type of challenge	Description
Communications	Traditional social mechanisms are lost or distorted [19, 49, 51] Communication dynamics such as facial expressions, vocal inflections, verbal cues, and gestures are altered [37, 52] Distinctions among member's social and expert status lost or distorted [9] Inhibition in building trust [33] Communication process dysfunction [23, 25, 52]
Culture	Potential for multiple cultures requires greater communication skills [49] Unrealistic cultural expectations [45] Communication may be distorted through cultural misunderstandings/biases [45]
Logistics	Multiple time zones make scheduling meetings as well as travel very difficult [45]
Technology	Technophobia [49] Need for proficiency across a wide range of technologies [49] Team membership bias toward individuals skilled at learning new technologies [49]

attempt to cope with a seemingly disjointed set of communications [25]. In such an environment, the nonsequential flow of information may eliminate or significantly reduce points of reference such that individuals may have difficulty in identifying how messages fit within the overall context of group communication [23]. Another problem is that individuals in asynchronous environments may tend to send longer, more carefully crafted messages, which may place an even greater information processing burden on team members as they attempt to decipher and act on these messages [23].

Such communication challenges may be exacerbated by global virtual teams composed of members with diverse ethnic, national, as well as organizational backgrounds. As team members communicate, they will tend to filter information through their inherent cultural biases, thereby giving rise to a potentially broad range of misinterpretations or distortions [45]. Although these cultural differences bring a greater variety of perspectives to bear on a problem domain, they may also create additional communications challenges for team members.

Another challenge is that heavy dependence on technology requires a high investment on the part of users to gain proficiency with new information technologies. Given the differences in individual predispositions to learn new technologies, membership on virtual teams may be highly biased toward those individuals skilled at learning new technologies, and against those who experience technophobia [49].

Given these challenges with communication, technology, logistics, and culture, we argue that virtual team environments may be more complex than their traditional counterparts. Solomon [45] supports this view:

The fundamentals of global team success aren't very different from the practices that work for domestic work teams. But there are more variables. Overlay cultural behavior and expectations on the roles of communication, team leadership and group dynamics, and you immediately understand. Moreover, there are logistics to overcome: challenges inherent in working in different time zones, lots of travel, and busy conflicting schedules. (p. 50)

These arguments suggest that certain leadership roles may be particularly important in virtual team settings. First, given the "altered" social context, leaders must be able to build and maintain a social climate necessary for ensuring adequate levels of team unity and cohesiveness. This is extremely important since group cohesion has been empirically linked to group effectiveness [36, 47]. Second, the role of managing/coordinating the communications process may take on heightened significance given the challenges noted above. The potential importance of these two roles suggests that virtual team leader effectiveness may be a function of the ability to display these (as well as other) roles simultaneously in complex virtual team settings. The following section draws from a variety of leadership theories to explore the notion of virtual team leadership effectiveness.

The Leadership Perspective

Although research on virtual team leadership effectiveness is very limited, our understanding of this subject can be informed by the significant body of general leadership literature as applied to small groups. Although a variety of frameworks exist that explain leadership effectiveness, most theories can be classified into one of three traditions: trait, behavioral, or contingency theories [46].

Proponents of the trait theory argue that effective leaders will possess certain innate qualities or characteristics (such as, intelligence, social maturity and breadth, inner motivation, human relations attitudes). Under this view, leaders are "born, not made" and the bulk of research has focused on identification of leadership attributes in order to predict the success or failure of potential leaders. Although there is some merit to this approach [38], a "pure" trait approach has fallen into disfavor [3] because it fails to take into account actual leader behaviors, as well as the contingency aspects of leadership.

In contrast, the behavioral view of leadership is a tradition that focuses on actual leadership behavior as opposed to innate qualities. Under this view, effective leadership can be characterized in terms of specific sets of observable activities that can then be used as a basis of comparison for leadership effectiveness [32]. Classic examples of this approach are Mintzberg's [42] managerial roles, Blake and Mouton's [4] managerial grid (initiating structure versus consideration), Theory X versus Theory Y [41], managers versus leaders [54], transactional versus transformation leaders [6], and autocratic versus democratic leaders. The popularity of this view is evident in more current team leadership literature that focuses on identifying critical behaviors or activities of successful team leaders [34, 35, 50]. Consistent with this behavioral

perspective, these typologies typically provide lists of key activities deemed important for effective team leadership. To illustrate this approach, examples of three such typologies are provided in Table 2.

In spite of its popularity, the behavioral approach to leadership still presumes “one best style” of leadership and fails to take into account the various contingencies that might occur in leadership contexts (such as, group characteristics and nature of task).

The contingency approach to leadership assumes that there is no one best style and that effective leadership depends on the fit between the leaders’ variables and situational variables [10, 46]. Path-goal theory [31] and situational leadership theory [20] are two examples of contingency-based leadership perspectives. Under this contingency perspective, a given manager’s leadership effectiveness will be dependent on his particular style as applied to specific circumstances. For example, an autocratic manager might be perceived as being highly effective under some circumstances (such as, military organizations) and ineffective under others (such as, academic institutions). As an example, Fry et al. [13] found that a task orientation (as opposed to relationship orientation) worked better in teams with high levels of interdependence. Early work by Fiedler [10] also demonstrated how relationship and task-oriented leadership styles could both be effective, depending on situational variables.

However, one problem with contingency-based theories of leadership is that they may be overly simplistic and fail to take into account that multiple leadership styles may be applicable across a broad range of circumstances [8]. Hooijberg et al. [30] articulate an alternative view of leadership. They state: “Most leaders interact almost simultaneously with a variety of stakeholders in multiple and rapidly changing settings covering a virtually endless list of contingencies” (p. 376).

This definition mirrors more recent developments in leadership theory, which suggest that effective leadership may be a function of the manager’s ability to display a varied and complex set of behavioral repertoires in response to complex organizational circumstances [8, 27, 28, 29, 30]. This behavioral complexity theory suggests that effective leaders must be able to deal with paradox and contradiction by performing multiple (and potentially competing) leadership roles simultaneously [8]. Whereas earlier contingency-based theories would identify the most appropriate leadership style for the given situation, this paradox perspective recognizes that the ability to perform multiple, contrasting leadership behaviors in a given situation may be a better indicator of effective leadership. Support for this theory has been found in numerous studies [2, 5, 8, 18, 28, 43]. Additionally, work by Stott and Walker [46] and Hackman and Walton [16] support the underlying principles of behavioral complexity. More specifically, they argue that effective team leaders will need to exhibit a varied set of roles related to three key dimensions of effective team functioning: task achievement, individual team members needs, and team cohesion. Thus, there is an emerging trend to view leadership effectiveness in terms of the ability to demonstrate multiple roles (such as, behavioral repertoires) in complex work contexts.

Applied to the virtual team context, behavioral complexity theory would suggest that effective virtual team leaders should exhibit a much more varied and complex set of behaviors or repertoires than those who are perceived to be less effective. Addi-

Table 2. Critical Behaviors for Effective Team Leadership

Jessup [34]	Katzenbach and Smith [35]	Wade et al. [50]
Administrator	Provide meaningful goals	Create a supportive environment
Coach	Build confidence and commitment	Develop trust
Advisor	Strengthen mix and level of skill	Create and communicate a clear vision
	Manage outside relationships	Act as a role model
	Create opportunities for others	Select effective team members
	Do real work	

tionally, given the inherent complexity of virtual team environments, it can be argued that effective virtual team leaders may exhibit higher levels of behavioral complexity than their traditional team counterparts. We thus propose that subordinates will perceive virtual leaders who exhibit multiple roles as more effective than virtual leaders who do not exhibit multiple roles. Effective virtual leaders will have teams that are satisfied with the communication, clear on their roles, and perceive communication effectiveness. We would also expect virtual teams with more effective leaders to produce more effective results. The following section describes the research methodology used to assess the relationship between behavioral complexity and leadership effectiveness in 13 global virtual teams.

Research Methodology

TO ASSESS VIRTUAL TEAM LEADERSHIP EFFECTIVENESS, we created 13 virtual teams, each composed of 5 to 7 members from 3 universities located in Europe, Mexico, and the United States. The teams were organized in a virtual matrix structure wherein team members report to two individuals (in this case, their respective professors and leaders) and team leaders, to a different individual (in this case, their respective professor). The participating European students were selected from an MBA program at a leading business school located in France. The Mexican participants were graduate students from a variety of technical and business backgrounds, and the U.S. students were composed of upper-level business undergraduates attending a cross-disciplinary introductory course to management information systems (MIS). Each virtual team contained one team leader from the European school and at least two students from each of the two remaining schools. High levels of prior work experience among team leaders helped to ensure a more realistic setting for the study. Finally, cultural diversity among teams was further enhanced by the multinational composition of the European MBA program.

Our strategy was to create highly diverse virtual teams of reasonable size to provide a realistic setting to study global virtual team dynamics. Since multiple nationalities were represented on each team, we could expect a requisite degree of diversity in

terms of language, customs, and perceptual differentiation. In addition, there was a wide range of technical competence among students, as well as a range infrastructure capability among member educational institutions. All of these factors helped to ensure a realistic setting for a virtual team not unlike those used by major organizations.

Task Assignment

Each team was assigned a mandatory task to complete a research project on a given topic assigned to them by the research team. Each project addressed a specific aspect of information technology, and team leaders were asked to produce a written report that specifically addressed the theme of the topic (see Appendix A for list of topics). Team leaders were given the following instructions by the research team:

You are not to research the content or write the report. Rather, you are to guide the team, give helpful comments on content, structure, organization, writing, and to point the members to appropriate places to find information and resolve any difficulties.

Although project teams members were given basic guidelines regarding project task and deliverables, no further advice was given to teams regarding how they were to accomplish the task. This was left up to the project team leader. In addition to being told the role of the leader, the team members also received the following instructions from their professors:

I will provide no guidance on how you are to complete this project. This guidance will come from your project leader counterpart in France. Your main objective will be to segment the work among yourselves and to complete the project as specified by the project leader. The exact details on how your group will communicate (e.g., frequency, what technology, time of day) will all be handled by your group.

Consequently, these guidelines helped to ensure that project team leaders would not do all of the work, and that high levels of communication among team members and their respective team leaders would be necessary to complete the task. Other than these specific guidelines, individual teams were given complete autonomy to assign priorities, set schedules, meeting times, and to decide on which telecommunications technologies to interact with. Although certain CMCSs were recommended (such as, TCBWorks, PowWow), none were required.

Each team member was evaluated on the overall quality of the final research paper and assigned an individual grade that was part of the overall grade for the class in which he was a participant. In addition, team leaders were asked to evaluate the individual performances of their respective team members and individual members were asked to rate the team leader's effectiveness. Each team was given approximately five weeks to complete the project.

Data Collection

Data were collected through a series of survey and open-ended questions administered upon the completion of the project (see Appendix B). Since the question of interest addressed leader effectiveness, project team leaders did not participate in completing the instrument. To assess the underlying factors of effective virtual team leadership, we measured participant perceptions along several variables: leader effectiveness, leader roles, perceived role clarity, communication effectiveness, communications satisfaction, and extent of communication technology use. These variables were measured as follows.

Leader Effectiveness

This was a five-item measure on a five-point Likert scale adapted from Denison et al. [8]. On a scale of 1 to 5 (poor = 1 and excellent = 5), participants were asked to rate their virtual team leader's performance. This was done to rate their virtual team leader's performance compared to other leaders under whom they had worked, and to rate their virtual team leader's performance as a role model. On a scale of 1 to 5 (failure = 1 and success = 5), participants were also asked to rate their assessment of their virtual team leader's managerial success. Finally, on a scale of 1 to 5 with (ineffective = 1 and effective = 5), respondents were asked to rate the overall managerial effectiveness of their virtual team project leader.

Leader Roles

To assess leader complexity, items were taken from Denison et al. [8] on the various roles of leaders. The scale is from *Almost Never (1)* to *Almost Always (5)*. These items were used to rate the extent that project managers exhibited leadership roles along each of the following eight dimensions:

Innovator role

- came up with inventive ideas
- experimented with new concepts and ideas

Broker role

- exerted influence in the virtual team

Producer role

- ensured that I met short-term stated goals
- ensured that I met long-term stated goals

Director role

- made my role very clear
- clarified my priorities and directions

Coordinator role

- anticipated problems and avoided crisis
- brought a sense of order into my work

Monitor role

- was in control of his/her work
- compared records, reports, and so on, to detect any potential problems

Facilitator role

- surfaced key difference among team members and then worked participatively to resolve them
- encouraged participative decision-making

Mentor role

- showed empathy and concern in dealing with me
- treated me in a sensitive, caring way

Role Clarity

This is a four-item measure taken from Fritz et al. [12]. On a five-point scale ranging from *To No Extent (1)* to *A High Extent (5)*, participants were asked the extent to which they agreed with the following statements:

- I felt certain about how much authority I had on this virtual team.
- I knew what my responsibilities were on this virtual team.
- I knew what was expected of me on this virtual team.
- I felt that I had sufficient time to perform.

Communication Satisfaction

This is a three-item measure taken from Fritz et al. [12]. On a scale of *Very Dissatisfied (1)* to *Very Satisfied (5)*, participants were asked to rate their satisfaction with the following:

- Your ability to find out about changes or news that affected your virtual team.
- Your ability to get help on virtual team-related problems.
- Your sense of belonging to the virtual team.

Communication Effectiveness

We assessed this variable through developing several items to measure communications quantity, quality, and clarity. The following items were used to measure these three dimensions of communications effectiveness. (See Appendix B, items 2–7 for actual scales.)

- In terms of the overall quantity of communication between yourself and your virtual team leader (VTL), how would rate this in terms of quantity?
- When you have required important information about the virtual team project, your VTL has communicated this information?
- In terms of the regularity of communication with your VTL, how would you rate this?
- In terms of the quality of the communication between you and your VTL, how would you rate this?
- When there are important changes/news concerning the project, your VTL communicated these changes:
- When you had important questions about the project, your VTL responded:

Extent of Communication Technology Use

Single-item questions measured the extent of a team's usage of a variety of communication technologies (see Appendix B, item 10, for list of technologies).

Team Effectiveness

To measure results, the instructors assessed the quality of the team reports submitted for a course grade. To ensure disinterested scoring, the grades were determined before the survey data was analyzed. The project grades are given in rank order, rather than as a raw number.

Quantitative Data Analysis

We conducted some preliminary quantitative analysis before proceeding with a qualitative assessment of the team leaders' and team members' personalized assessment of their virtual teams. Cronbach reliability analysis was conducted on the variables measured to confirm their reliability. Table 3 presents the variables, means, standard deviations, and Cronbach alphas. As can be seen, the alphas are very high. There is no reliability for the "Broker" role, as it was comprised of a single item.

Regression was run using leadership effectiveness as the dependent variable, and the various roles and technology variety as independent variables. The regression is significant ($F = 7.46, p > 0.000$), however, the only role to significantly predict leadership effectiveness is that of Mentor ($t = 3.547, p > 0.001$).

MANOVA was run using Communication Effectiveness, Communication Satisfaction, and Role Clarity as dependent variables, and Leadership Effectiveness as the independent variable. Leadership Effectiveness was a strong predictor of the dependent variables ($F = 6.69, p > 0.000$; $F = 6.984, p > 0.000$; and $F = 5.359, p > 0.000$, respectively).

The data was aggregated according to team, as shown in Table 4. Inter-rated reliability scores were computed for each team (that is, a measure of the extent of agreement among team members in response to the questions). These scores are given in Table 4. Three teams have troublesome scores—Teams 8, 11, and 12, indicating low

Table 3. Descriptive Statistics and Cronbach Alpha Reliability

Variable	Mean	Standard deviation	Reliability
Leader effectiveness	3.46	0.74	0.95
Leader roles:			
Overall	3.17	0.82	0.93
Innovator	2.68	0.86	0.87
Broker	3.40	1.08	—
Producer	3.25	1.04	0.89
Director	3.01	1.06	0.86
Coordinator	3.04	1.07	0.81
Monitor	3.09	1.03	0.65
Facilitator	2.97	1.06	0.60
Mentor	3.41	0.82	0.86
Communication effectiveness	3.16	0.74	0.78
Communication satisfaction	3.26	0.86	0.78
Role clarity	3.47	0.78	0.83

agreement (high standard deviations) among team members as to their perceptions of the team. The remaining 10 teams have acceptable inter-rated reliability.

We then took the mean of leadership effectiveness (3.46) and plotted the teams according to leadership effectiveness. The distribution is normal with three teams having leaders with a score greater than one standard deviation above the mean (Teams 4, 5, and 11) and three teams having leaders with a score less than one standard deviation below the mean (Teams 3, 8, and 13).

Since information technology use was an important component of team functioning, Table 5 has been provided to compare technology use across teams. For illustrative purposes, the mean leader-effectiveness score has been added and individual entries have been sorted and separated into three clusters (high, medium, and low) of leader effectiveness. This table indicates that the leaders from the highest cluster (teams 4, 5, 11, and 7) were from teams that either used technology more extensively or were simply able to use a single technology (such as, e-mail) more effectively. In contrast, the lowest cluster of teams (1, 12, 2, 8, 3) used e-mail as their sole means of communication and were not very effective at doing so. Also, several teams from this lowest cluster were unsuccessful at attempts to use Web-based collaboration tools (such as, PowWow). Although we cannot draw statistical conclusions from this evidence, these results suggest a possible relationship between leadership effectiveness and level of technology use among team members.

Summary of Quantitative Data

According to the survey data, leadership effectiveness exhibited marked variation among the 13 teams. Leadership effectiveness was most closely associated in the

Table 4. Team Scores and Inter-Rater Reliability

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13
Inter-rater reliability	0.86	0.68	0.69	0.70	0.086	0.77	0.96	0.34	0.91	0.90	0.55	0.24	0.73
Number responses	3	3	4	5	4	5	5	4	5	5	3	4	4
Mean leader effectiveness	3.0	2.80	2.25	4.56	4.4	3.76	4.08	2.7	3.44	3.85	4.27	2.85	2.45
Standard deviation leader effectiveness	0.53	0.8	0.79	0.78	0.52	0.68	0.3	1.15	0.41	0.44	0.95	1.23	0.74
Project quality	8	3	10	1	5	7	11	8	4	9	2	6	13
Technology used: 1. e-mail; 2. fax; 3. face; 4. phone; 5. Web	1,3	1,2	1,3,4	1,2,5	1,2,5	1,2	1	1	1,5	1	1	1,5	1
Communication effectiveness	3.07	3.13	2.65	3.88	4.25	2.96	2.8	2.65	3.36	3.56	3.6	2.95	2.1
Communication satisfaction	3.42	3.25	2.44	4.1	4.19	2.95	3.15	2.81	3.85	3.8	3.25	2.94	1.94
Role clarity	3.56	3.22	3.17	3.87	4	3.8	3.8	2.67	3.93	3.6	3.44	3.17	2.42
Leadership roles:													
Innovator	2.33	2.5	2.25	2.8	3.88	3.5	2.2	1.88	3.2	2.63	4.0	2.5	1.88
Broker	2.33	3.67	2.75	3.6	4.5	4.4	2.8	3.0	3.8	3.5	3.67	3.75	2.0
Producer	3.0	3.17	2.63	4.2	3.88	3.4	3.0	2.63	3.8	3.5	5.0	2.75	2.0
Director	2.83	3.0	2.75	3.6	3.75	2.7	3.2	2.38	3.5	3.5	4.83	2.63	1.38
Coordinator	3.33	2.5	2.5	4.2	3.63	2.9	2.6	2.5	3.5	3.25	3.73	3.0	1.63
Monitor	3.17	2.33	2.75	4.4	3.63	3.1	2.3	2.63	3.5	3.50	3.73	3.13	1.75
Facilitator	2.0	3.0	2.0	4.0	4.13	3.4	2.4	2.5	3.6	3.25	3.17	3.0	1.63
Mentor	2.83	3.5	3.25	4.6	3.75	3.6	3.5	2.38	3.3	3.67	3.5	4.0	2.0

Table 5. Team Use of Computer-Mediated Communication Systems

Team number	Technology use	Mean leader comments	Effectiveness
4	E-mail, virtual chat (mIRC), Web page	Used e-mail for individual communication and virtual chat for group interaction	4.56
5	E-mail, PowWow, Web page	Used e-mail for daily messages, PowWow for group conferencing, and Web page to store research information.	4.40
11	E-mail	E-mail was effective due to low number of team members.	4.27
7	E-mail	E-mail was effectively used to share ideas, suggestions, and questions.	4.08
10	E-mail	E-mail was not effective.	3.85
6	E-mail	E-mail used to communicate effectively across time zones.	3.76
9	E-mail, PowWow, Web pages	E-mail used to communicate meeting schedules and individual progress. Web page used as "home base" of operation display agendas and project progress. PowWow used as a collaborative tool to facilitate group planning and implementation.	3.44
1	E-mail	Did not use Web technology because of lack of technology in Mexico.	3.0
12	E-mail	Tried to use PowWow, but were unsuccessful.	2.85
2	E-mail	E-mail was ineffective with long delays in sending and receiving e-mails.	2.8
8	E-mail	Group suggested use of collaborative tool, however, project manager did not feel it was necessary.	2.7
3	E-mail	Group tried to use collaborative CMCS, however, project manager did not express support of this move.	2.25

virtual environment with the mentoring capabilities of the leader. Additionally, survey results indicate that effective leadership is associated with team member perceptions of communication effectiveness, communication satisfaction, and the ability of the leader to establish role clarity among team members. Although the small number of teams precludes a quantitative evaluation using the team score as a dependent variable, one can see in Table 4 that the projects ranked highest in terms of quality were in fact received by the teams with the leaders who received high effectiveness scores.

Our survey results can be supplemented through a qualitative analysis of both leader and team member responses to open-ended questions. The following section presents these qualitative findings on leadership effectiveness, first from the standpoint of the team member, and then from the perspective of the project team leader.

Qualitative Analysis of Member and Leader Responses

Leadership Effectiveness—The Team Members' Perspective

Team members were asked their reflections on effective and ineffective global virtual team leadership, and team leaders were asked to write reports indicating their analysis of their own leadership. The team member responses revolved primarily around four critical issues: communication, understanding, roles, and attitude.

Communication. In terms of communication, members who felt that their leaders did not respond to questions promptly voiced complaints. Comments by team members of leader's with low effectiveness scores reflected this dissatisfaction. Members complained of leaders who "never acknowledged our suggestions" or who "failed to give us direction." In contrast, other teams who rated their team leaders as being highly effective commented on their leader responsiveness to a variety of project-related issues and questions:

Our group leader was very effective in directing our teams' activities. She contacted us promptly with her ideas concerning the electronic commerce project. She responded quickly to questions and comments that the team members had.

Gabriel (name disguised) was an extremely effective team leader in our virtual team project. He provided us with a clean and precise outline of goals, he spoke/wrote excellent English and he answered our questions promptly.

Another frequent communication complaint was that the leader was too vague. The word vague appeared frequently, and mostly in the context of an ambiguous assignment of tasks. The members wanted more detail and "clear division of tasks." They desired specific messages about what needed to be done and when. Members were irate when a leader would tell them of a deadline one day in advance and expect their compliance. They complained about a leader "assigning a deadline without asking us how much time we needed."

Turning in materials to the leader but receiving no comments or feedback also bothered members. In contrast, effective leaders were perceived to have willingly provided continuous feedback and suggestions regarding team activities.

He was also willing and anxious to hear our opinions and ideas on the topic. After hearing our suggestions, he would direct and advise us.

Three teams used Web collaboration tools (see Table 5). Among these, one leader designed a home page to house team information and progress. It is not surprising that this team (Team 4) had the highest rated leader. Additionally, this team also engaged in weekly 1.5-hour chat sessions to facilitate communication. Although one team member claimed to “not see the point of spending 1.5 hours every week on PowWow,” others enjoyed the closer relationship they felt they developed with the leader and team members, the “high level of trust,” and the “unique working relationship” that developed as a result of the extensive communication. This anecdotal evidence is consistent with prior research that establishes a link between group cohesiveness and performance [36, 47]. To summarize, the most effective leaders (based upon team members’ perceptions) were those who communicated regularly, answered team member questions, provided feedback, gave directions, and approached the members with a cordial, yet assertive tone.

Understanding. A common word used to describe leaders who received high effectiveness ratings was “understanding.” This may correspond to the mentoring variable highlighted in the quantitative findings. The leaders receiving praise from their members did so for being “sensitive to our schedules,” for “caring for all our members,” and for “appreciating our opinion and suggestions.”

Complaints were voiced against leaders who did not exhibit empathy: “to him the topic was easy, but to us it was very complicated and difficult to understand.” Low-scoring leaders received comments such as “he needed to be more understanding of people in the group who have opposing views and suggestions.” Members wanted to know about their leaders and wanted their leaders to express interest in them. Some members bemoaned a leader who “never wanted to know anything about us” or who “didn’t tell about herself.” One leader received vitriolic comments from members, who felt scorned and “looked down upon” by their leader.

Roles. Some team leaders did a better job of clarifying their role, and the roles of the members, than did others. A major complaint against low-performing leaders was that they were not authoritative enough, not clear on responsibilities, and not involved with the group. Regarding their virtual team leader, members from Team 8 commented:

Unfortunately he did not follow up in a good, effective way in guiding the team. He basically just let us work with these first [initial] guidelines which were very broad. He should have given us more specific guidelines on what to cover, and followed it up with even more information throughout the process.

Evidently, the team members did not want a distant dictator, but a distant mentor—someone who pointed them in the right direction, who suggested to them where to locate relevant information, who commented on their work, and encouraged their progress. Disappointment was voiced against leaders who “didn’t help us with what changes needed to be made,” who “gave no feedback on our work,” or who “just sent assignments and left us out to dry.” Evidently, at least one leader responded to the lack of participation of certain students by merely reassigning their tasks to performing members. This was not appreciated:

Demand that everyone do their part. Don’t just shove extra work on the people who are doing their job.

The U.S. students frequently complained that the leaders did a poor job of eliciting participation from their Mexican counterparts. The most effective leaders did not assign responsibilities to the Mexican students, once they realized incompatibilities of goals and language. They managed the problem not by reassigning the Mexican member roles to U.S. students, but by assigning the Mexicans a different role, one that they could perform. Members wanted leaders who were involved in the work itself, not who just delegated and watched.

Attitude. Finally, the members were very aware of the leader attitudes. Three teams with low-scoring leaders complained that their leader was either too arrogant or too timid. Members complained about a leader who “was not assertive enough,” “very distant,” or “too bossy.” Members wanted clear directives, but also wanted a leader who communicated “to our level.” However, they reacted against leaders they perceived as having “a superiority attitude.” At the same time, team members also wanted to be challenged to excel:

I didn’t feel like I was being pushed to do well. I must admit I didn’t do my best because I didn’t feel encouraged and pushed along.

There can be a fine line between assertiveness and bossiness. The importance of attitude is perhaps best illustrated in the case of one team member who stated:

[He] asked for an outline/draft of our part of the paper. Some actually submitted the entire full copy. When we had our PowWow meeting, he gave me a hard time for not submitting my entire paper even though I was following his instructions.

Although the leader might not have intended to scold the member, the member felt a lasting sting from the event. Since the virtual environment may hinder the awareness of such misunderstandings, this increases the need to be vigilant of one’s attitude.

Summary of Results from the Team Members’ Perspective

These qualitative results corroborate the findings from our analysis of the surveys and suggest that virtual team leader effectiveness may be related to a variety of underlying

factors including: the ability to communicate, leader understanding (empathy), role clarity (definition), and leader attitude toward team members. Interestingly, these virtual team findings are consistent with traditional small group leadership literature. Table 6 illustrates this similarity.

Leadership Effectiveness—The Leaders' Perspective

From the leaders' perspectives, the primary problems with the teams centered on member motivation and behavior, lack of control mechanisms, and technology problems. The only commonality between leader and member comments relates to communication: Members complained of poor patterns of leader communication, whereas leaders attributed poor member communication to a lack of motivation. Leaders described members who did not respond to messages, refused to comply with deadlines, lacked basic team skills, were "insufficiently open-minded," and who had no common goals. Leaders varied in their ability to cope with these challenges. For example, less effective leaders would generally delay a given action or decision until all team member responses had been received. Although they were not obliged to retain nonparticipating members as part of the team, leaders who allowed these students to delay progress and impede team spirit never fully got the team together.

Leaders also complained about lack of response to their e-mails. The leaders believed that they sent "enthusiastic warm welcome" messages, "explicit expectations," and "motivating feedback and direction," to which they encountered "lack of engagement," "poor feedback," and "passive style" from their team members, which resulted, in their opinions, in "an unstable process," and "mediocre performance." Leaders clearly had a higher standard of quality to which they were accustomed, and most were unable to elicit a higher quality from the team members than the team members were accustomed. Team 4, the highest scoring team, seemingly had a good experience. The leader reports that they began with "a lot of fun and optimism" and he immediately scheduled an online chat to get the team moving together. They had "constructive" weekly chats and used the Web site "to exchange documents and to make it easy for anyone to join us at any time." This leader structured the communication patterns, produced the "team agendas, outlined the draft report, and provided a detailed work plan." This leader also had problems with the participation of the Mexican students, but he responded by explaining to the U.S. students that it was a language and technology problem and that they needed to exercise patience and understanding. He stated: "our efforts to keep them involved were hard but did end up in them writing the first important chapters of the end report."

Most leaders felt that if they had more direct control of rewards (that is, grades), they could have better motivated the students. However, they were requested to rate each student on the project and their assessment was to count in the assignment of the members' project grades. Nevertheless, the leaders felt powerless to motivate without the potential for reward and punishment.

Likewise, the leaders felt hampered by e-mail technology. The most common problem encountered was the inability to send and receive e-mail messages. Although all

Table 6. Characteristics of Effective Virtual Team Leaders

Dimension of effective leadership	Description of an effective virtual team leader	Support from prior literature
Communication	Provides continuous feedback Engages in regular, prompt communication Provides a clear, detailed "picture" of tasks	[16, 23, 24, 25, 26, 53]
Understanding	Sensitive to schedules of team members Appreciative of team member opinions and suggestions Exhibits care and concern over team member problems Expresses a personal interest in team members Gets to know other team members	[14, 16, 34, 35, 39, 46]
Role clarity	Clearly defines responsibilities of all team members Able to exercise authority to ensure follow-through on assigned responsibilities Able to mentor virtual team members in a "hands-on" fashion	[35, 46, 48]
Leadership attitude	Assertive—yet not overbearing or "bossy" Caring—yet not timid Ability to relate to team members at their own level Consistency over the life of the project	[14, 53]

three locations experienced difficulties with technology (such as, servers occasionally down), the problems were more acute with the Mexican team members. One participant said: "Our group was constantly having problems with emails from Mexico. The messages were either too large or the contents were not transmitted properly. Perhaps if we had set up a web-page, we could have eliminated some of our problems."

Several leaders coped by developing Web sites and having Web-based chat sessions, both of which were well received by team members. Others continued with e-mail only, although they recognized this to be a limitation and blamed their own weak performance on the technology. However, the groups using the Web-based collaboration tools were not immune to technology problems. One group using PowWow found that that program inexplicably kicked chat participants out of the session without warning. Moreover, there was a slight delay in messages being sent and received, often resulting in an overlap and nonlogical sequencing of messages. Thus, regardless of whether groups relied solely on e-mail or on e-mail and chat sessions, technological frustrations occurred.

In addition to these technological barriers, there was some evidence that variance among individual's level of skill or familiarity with information technology may have

played a significant role in team success in utilizing rich CMCS. Table 5 lists the types of technology employed by each group, based on the member and leader responses. One group noted: “When we began this project, our technical knowledge was limited. When our team leader suggested the use of PowWow for ‘face to face’ meetings, we were not sure how to access this service.” This comment suggests that some level of technical expertise may play a pivotal role in a virtual teams’ ability to adopt and successfully use innovative information technologies. Moreover, it suggests that virtual team leaders must assume the role (perhaps unwanted) of teaching members how to use the technologies in such a way that the members are not intimidated into becoming silent observers.

The team leaders had high performance expectations, and all but two (Teams 4 and 5) expressed disappointment with the quality of their teams’ project. The leaders tended to blame the students and the structure rather than themselves. Indeed, in all 13 reports submitted by the leaders reflecting on their experiences, only 1 suggested things he could have done differently—“maybe I could have improved my effectiveness by exercising more pressure on the responsible teachers in the United States and Mexico. In a professional setting, I would have done it.” It is telling that the leaders saw themselves as helpless, powerless, and yet flawless.

The problems experienced by the team leaders are not unusual for matrix structures in a virtual environment. Where team leaders are required to manage members who do not report directly to them in terms of promotion, motivation can be challenging. Where standards of quality and norms of teamwork vary (as they often do across cultures and disciplines), establishing common goals and expectations is difficult. However, the creative leader finds mechanisms to address these challenges, rather than abandoning a team to itself.

Discussion

The Behavioral Perspective of Leadership

FIRST, OUR FINDINGS LEND SUPPORT to the behavioral perspective of leadership effectiveness. Early behavioral approaches to leadership suggest that effective leaders are those who engage in two basic activities: initiating structure and consideration [3, 44]. Initiating structure refers to task-related activities, whereas consideration (human relations) relates to the extent of care and concern for team members [46]. Under this theory, effective leaders are those able to maximize both orientations for both task achievement and team member satisfaction. From Table 6, it is evident that the communications and role clarity dimensions identified in this study are primarily targeted at task achievement (initiating structure), whereas understanding and leadership attitude are primarily focused on the human relations aspect (consideration) of team functioning. Thus, leaders perceived as effective in our study were attentive to both the relational as well as the task-related features of their jobs.

Consideration

Leaders exhibited strong relational skills through their mentoring activities with team members. First and foremost, team members wanted a mentor—someone to guide, to encourage, to challenge, and to motivate them to excellence. In contrast, leaders seemed to want more independent members who did not require “hand-holding” and who could be assigned tasks and then left to act independently. Those virtual team leaders perceived to be highly effective expressed care, concern, and understanding toward team members, yet, at the same time, they were able to assert their authority to achieve team goals. Moreover, effective leaders were able to engage team members in a very personal, collaborative fashion and to simultaneously maintain their “distance” as authority figures. Our evidence also suggests that this mentoring capability is reflected in the leader’s ability to build healthy social climates for team members to interact with each other. In contrast, ineffective leaders were generally perceived to lack empathy and to be detached from the management process.

Initiating Structure

In conjunction with these relational skills, effective leaders were perceived to have exhibited a great deal of ability in task-related (initiating structure) skills. Effective leaders provided constant feedback, guidance, suggestions, coaching, and understanding relative to a wide range of virtual team issues. Furthermore, they were able to effectively “move” their groups to task completion through consistent communication, detailed instructions, and rapid feedback. Most important, effective leaders demonstrated the ability to clearly articulate the responsibilities of team members and to exercise authority to ensure follow-through on assigned tasks. Table 7 summarizes these findings.

The Contingency Perspective of Leadership

As Table 6 illustrates, the core attributes of leadership effectiveness in our virtual team study do not appear to vary significantly from what would be expected of traditional teams. Thus, the critical roles identified in this study (such as, mentoring, communication effectiveness, and role clarity) should also be important in traditional settings. In spite of these similarities, we argue that the *emphasis* of certain roles may differ significantly between virtual and face-to-face settings. Thus, although communication may still be important in traditional teams settings, it may take on added importance in distributed groups [25, 26] as indicated in this study. Likewise, building and maintaining a proper social climate may become a vitally important activity for leaders of virtual teams. The contingency view simply suggests that the attributes of effective team leadership will be dependent on the situation.

Drawing from this perspective, our results suggest that the nature of group interaction (such as, face-to-face versus virtual) represents one situational factor that may

Table 7. An Explanation of Study Results Using Multiple Theoretical Perspectives

	The behavioral leadership perspective	Contingency theory of leadership	Behavioral complexity
<p>Characteristics of effective virtual team leaders:</p> <ul style="list-style-type: none"> • Communication skills. • Understanding disposition. • Ability to achieve role clarity among team members and to exercise authority in follow-through of responsibility. • Ability to maintain a caring, yet assertive attitude toward team members. 	<p>Effective leaders are able to optimize both relational (consideration) and task-related (initiating structure) orientations.</p> <ul style="list-style-type: none"> • Consideration was evident through virtual team leader attentiveness to maintaining an understanding disposition and caring attitude toward team members. • Initiating structure was evident through virtual team leader's attentiveness to both communication skills as well as role clarity. 	<p>Effective leadership depends on situational factors related to task, group, and technology.</p> <ul style="list-style-type: none"> • Our findings suggest that the leadership roles of communications processor and social facilitator may be vitally important for situations where groups are dispersed and linked through CMCS. 	<p>Effective leadership is dependent on ability to display multiple, contrasting styles in complex settings.</p> <ul style="list-style-type: none"> • Effective leaders demonstrated capability to simultaneously engage in multiple, competing roles: assertiveness and understanding. • Effective leaders exhibited both social and cognitive complexity as evidenced by social as well as task awareness.

influence the relative importance of certain key leadership roles. More specifically, in virtual teams settings, the leadership roles of social facilitation and communications processing may take on added importance as compared to more traditional work groups (see Table 7). Our results indicate that these two leadership roles may be extremely important in virtual team settings. Future research should seek to understand the relative importance of these and other roles in virtual team environments.

Another contingency present in virtual team settings has to do with the nature of the technology used to link teams together. Goodman [14] and others [15] suggest that tasks are embedded within larger technological systems and that the underlying technology confronted by work groups in task achievement may have a significant influence on constraining and patterning group activity. Therefore, work group effectiveness may be largely dependent on the ability to align group structure and technology with the task environment [7, 14]. Since group structure and task components of this “equation” may be relatively fixed from the leader’s perspective, the ability to effectively manage one’s technological environment may be a key component of effective leadership. Thus, a leader’s ability to appropriately structure the available technology to meet task demands and group requirements may be a critical role in dispersed settings like those examined in this study. It is interesting to note that the two leaders rated as most effective in this study (Teams 4 and 5) were from teams that exerted some degree of influence on their technological environment through building team Web sites to facilitate task achievement. Future research should seek to examine the extent to which successful virtual team leaders are able to exert control over their respective technological environments.

Behavioral Complexity Theory of Leadership

Our results seem to be consistent with the behavioral complexity perspective on leadership effectiveness. First, more effective leaders appeared to display a wider degree of behavioral repertoires (behavioral complexity) as evidenced by activities related to tasks (role clarity and communication) as well as relationships (mentoring, understanding, and attitude). Our evidence indicates that effective leaders simultaneously demonstrated the ability to be assertive and authoritative while still remaining understanding and empathetic toward team members. Given the potentially competing and paradoxical nature of these two roles, these findings suggest that leaders who were effective in these roles exhibited higher levels of behavioral complexity. Conversely, less effective leaders did not exhibit the ability to simultaneously carry out these two roles.

Whereas our results seemed to be most closely aligned with the behavioral perspective of leadership (such as, effective leaders are able to demonstrate strong relational as well as effective task related skills), support for the other two perspectives of leadership is also evident. First, the basic tenet of the behavioral complexity model (effective leaders are able to exhibit multiple contrasting leadership styles in complex settings) was actually demonstrated by the effective leaders in our study who excelled at both contrasting styles of task management (initiating structure), as well as relational (consideration) skills. Thus, from our view, these two theories are entirely consistent and

supportive of each other. Although support for the contingency perspective (Table 7) did not seem to be as clear, it is apparent from our findings that the contingency of a virtual environment did place an added emphasis on leader communication and relational skills. Thus, according to the contingency perspective, effective leaders in our sample should have been those best able to match their particular leadership style with these contingencies of the situation. Since we did not capture data on leadership style this relationship cannot be substantiated.

Limitations and Conclusions

OUR STUDY HAS SEVERAL LIMITATIONS. First, since our findings are based on a limited sample, this may restrict our ability to generalize these results to other settings. Second, these findings may only be applicable to cultures similar to those represented by the subjects of this study (such as, American, Mexican, and European). Had our study included members from other cultures (such as, Asian), significantly different findings may have occurred. Future studies should seek to identify how the characteristics of virtual team leadership may vary across a variety of cultures. Concurrently, future research should also seek to identify those underlying factors of virtual team leadership that are universal in nature and seem to transcend culture. Third, we employed a simple, subjective measure of technology use. Whereas the variance in technology use was not a significant variable in our research design, such variation might have major implications for team leader effectiveness. How well a team leader manages and uses technology merits attention in future research. Fourth, because our teams were comprised of several members from the United States and several from Mexico, subgroup formations occurred wherein face-to-face meetings were possible. Such subgroup meetings might have had beneficial or negative consequences for the teams. We did not study the formation of subgroups, but this is another interesting avenue for future research.

In spite of these limitations, valuable findings have emerged from this research. The answer to our research question—*What factors contribute to effective leadership in virtual team environments?*—has yielded some interesting results. Virtual team leaders rated as effective by their members, demonstrate first and foremost a mentoring quality characterized by concern for the members, understanding, and empathy. Although these qualities may also describe effective leaders in face-to-face environments, the difference might well be in the ability of the virtual leader to project these qualities. It may be that the ineffective leaders also possessed these qualities but were unable to project them. In fact, one can argue that the problem set facing virtual teams is in fact little different from the problem set facing traditional teams with such problems as motivating members, monitoring quality, avoiding misunderstanding equally significant in both environments. However, the solution set at the disposal of the virtual leader is arguably smaller than the solution set available in traditional environments. The virtual leader is unable to meet one-on-one with problem members, is unable to reassure members of his own work ethic by continuous physical presence, is unable to communicate messages that he might not wish recorded. In essence,

because of the smaller solution set, the virtual environment might actually be simpler rather than more complex than the traditional environment. Rather than needing to project many roles simultaneously, it may be that the virtual leader is skilled at the single role of mentor with written communication skills that enable him to clarify roles, maintain a structure to a flow of messages, and exhibit an assertive yet caring persona. This poses the question of whether, in assuming that the absence of nonverbal communication cues renders an environment more complex, researchers have searched for complicated answers to what might in fact be simple problems. In treating the virtual environment as more simple than the traditional environment, researchers might be led to investigate questions of how to usefully employ the technology so that differences in member comfort and agility with technology are nondisruptive, how to train leaders to structure information flow among members, and how to manage member and leader expectations.

Acknowledgment: The authors are very grateful to Manuel Mora-Tavarez for his assistance with this project and to the anonymous reviewers for their constructive feedback. The authors thank the Hankamer School of Business at Baylor University at INSEAD for financial support of this project.

REFERENCES

-
1. Ahuja, M.K., and Carley, K.M. Network structure in virtual organizations. *Organization Science*, 10, 6 (November/December 1999), 741–757.
 2. Bass, B.M. *Stogdill's Handbook of Leadership: A Survey of Theory in Research*. New York: Harper, 1981.
 3. Bass, B.M. *Handbook of Leadership: Theory, Research, and Managerial Applications*. New York: The Free Press, 1990.
 4. Blake, R.R., and Mouton, J.S. *The Managerial Grid*. Houston: Gulf Publishing, 1964.
 5. Bullis, R.C. The Impact of Leader Behavioral Complexity on Organizational Performance. Ph.D. dissertation, Texas Tech University, Lubbock, TX, 1992.
 6. Burns, J.M. *Leadership*. New York: Harper, 1978.
 7. David, F.R.; Pearce, J.A.; and Randolph, W.A. Linking technology and structure to enhance group performance. *Journal of Applied Psychology*, 74, 2 (April 1989), 233–241.
 8. Denison, D.R.; Hooijberg, R.; and Quinn, R.E. Paradox and performance: Toward a theory of behavioral complexity in managerial leadership. *Organization Science*, 6, 5 (September/October 1995), 524–540.
 9. Dubrovsky, V.; Kiesler, S.; and Sethna, B. The equalization phenomenon: Status effects in computer-mediated and face-to-face decision making groups. *Human-Computer Interaction*, 6, 1 (1991), 119–146.
 10. Fiedler, F.E. *A Theory of Leadership Effectiveness*. New York: McGraw-Hill, 1967.
 11. Fjermestad, J., and Hiltz, S.R. An assessment of group support systems experiment research: Methodology and results. *Journal of Management Information Systems*, 15, 3 (Winter 1998–1999), 7–149.
 12. Fritz, M.B.W.; Sridhar N.; and H.-S. Rhee. Communication and coordination in the virtual office. *Journal of Management Information Systems*, 14, 4 (Spring 1998), 7–28.
 13. Fry, L.; Kerr, S.; and Lee, C. Effects of different leader behaviors under different levels of task interdependence. *Human Relations*, 39, 12 (December 1986), 1067–1082.
 14. Goodman, P.S. *Designing Effective Work Groups*. San Francisco: Jossey-Bass, 1986.
 15. Goodman, P.S.; Ravlin, E.; and Schminke, M. Understanding groups in organizations. In B.M. Staw and L.L. Cummings (eds.), *Research in Organizational Behavior*, vol. 9. Greenwich, CT: JAI Press, 1987, pp. 121–173.

16. Hackman, J.R., and Walton, R.E. Leading groups in organizations. In P.S. Goodman (ed.), *Designing Effective Work Groups*. San Francisco: Jossey-Bass, 1986, pp. 72–119.
17. Hare, A.P. *Handbook of Small Group Research*. New York: The Free Press, 1976.
18. Hart, S.L., and Quinn, R.E. Roles executives play: CEOs, behavioral complexity, and firm performance. *Human Relations*, 46, 5 (May 1993), 543–574.
19. Heimstra, G. Teleconferencing, concern for face and organizational culture. In J. Burgoon (ed.), *Communication Yearbook: An Annual Review Published for the International Communication Association*, vol. 6. Beverly Hills, CA: Sage, 1982, pp. 874–904.
20. Hersey, P., and Blanchard, K. *Management of Organizational Behavior: Utilizing Human Resources*. Englewood Cliffs, NJ: Prentice Hall, 1977.
21. Hightower, R.T., and Sayeed, L. The impact of computer mediated communication systems on biased group discussion. *Computers in Human Behavior*, 11, 1 (1995), 33–44.
22. Hightower, R.T., and Sayeed, L. Effects of communication mode and pre-discussion information distribution characteristics on information exchange in groups. *Information Systems Research*, 7, 4 (December 1996), 451–465.
23. Hiltz, S.R., and Johnson, K. User satisfaction with computer-mediated communication systems. *Management Science*, 36, 6 (June 1990), 739–764.
24. Hiltz, S.R., and Turoff, M. *The Network Nation*. Reading, MA: Addison-Wesley, 1976.
25. Hiltz, S.R., and Turoff, M. Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM*, 28, 7 (1985), 680–689.
26. Hiltz, S.R.; Dufner, D.; Holmes, M.; and Poole, S. Distributed group support systems: Social dynamics and design dilemmas. *Journal of Organizational Computing*, 2, 1 (1991), 135–159.
27. Hooijberg, R. Behavioral complexity and managerial effectiveness: A new perspective on managerial leadership. Ph.D. dissertation, University of Michigan, Ann Arbor, 1992.
28. Hooijberg, R. A multi-directional approach toward leadership: An extension of the concept of behavioral complexity. *Human Relations*, 49, 7 (July 1996), 917–946.
29. Hooijberg, R., and Quinn, R.E. Behavioral complexity and the development of effective managerial leaders. In R.L. Phillips and J.G. Hunt (eds.), *Strategic Management: A Multi-Organizational Perspective*. New York: Quorum, 1996, pp. 161–176.
30. Hooijberg, R.; Hunt, J.G.; and Dodge, G.E. Leadership complexity and development of the leaderplex model. *Journal of Management*, 23, 3 (1997), 375–408.
31. House, R., and Mitchell, T. Path-goal theory of leadership. In K. Davis (ed.), *Organizational Behavior*. New York: McGraw-Hill, 1977, pp. 445–447.
32. Hoy, W., and Forsyth, P. *Effective Supervision: Theory into Practice*. New York: Random House, 1986.
33. Jarvenpaa, S.L.; Knoll, K.; and Leidner, D.E. Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14, 4 (Spring 1998), 29–64.
34. Jessup, H.R. New roles in team leadership. *Training and Development Journal*, 44, 11, (November 1990), 79–83.
35. Katzenbach, J.R., and Smith, D.K. *The Wisdom of Teams*. Boston: Harvard Business School Press, 1993.
36. Keller, R.T. Predictors of the performance of project groups in R & D organizations. *Academy of Management Journal*, 29, 4 (December 1986), 715–726.
37. Kiesler, S., and Sproull, L. Group decision making and communication technology. *Organizational Behavior and Human Decision Processes*, 52, 1 (June 1992), 96–123.
38. Mann, R.D. A review of the relationship between personality and performance in small groups. *Psychological Bulletins*, 56, 4 (1959), 241–270.
39. McDermott, L.C.; Brawley, N.; and Waite, W.W. *World Class Teams*. New York: John Wiley & Sons, 1998.
40. McGrath, J.E., and Hollingshead, A.B. *Groups Interacting with Technology: Ideas, Evidence, Issues, and an Agenda*. London: Sage, 1994.
41. McGregor, D. *Human Side of Enterprise*. New York: McGraw-Hill, 1960.
42. Mintzberg, H. *The Nature of Managerial Work*. New York: Harper and Row, 1973.
43. Quinn, R.E.; Spreitzer, G.M.; and Hart, S. Challenging the assumptions of bipolarity: Interpenetration and managerial effectiveness. In S. Srivastava and R. Fry (eds.), *Executive and Organizational Continuity*. San Francisco: Jossey-Bass, 1991, pp. 222–252.

44. Rambo, W.W. *Work and Organizational Behavior*. New York: CBS College Publishing, 1982.
45. Solomon, C.M. Global teams: The ultimate collaboration. *Personnel Journal*, 74, 9 (September 1995), 49–58.
46. Stott, K., and Walker, A. *Teams, Teamwork, and Teambuilding*. Singapore: Prentice Hall, 1995.
47. Summers, I.; Coffelt, T.; and Horton, R.E. Work group cohesion. *Psychological Reports*, 63, 2 (1988), 627–636.
48. Sundstrom, E.; deMeuse, K.P.; and Futrell, D. Work teams: Applications and effectiveness. *American Psychologist*, 45, 2 (1990), 120–133.
49. Townsend, A.M.; deMarie, S.M.; and Hendrickson, A.R. Virtual teams and the workplace of the future. *Academy of Management Executive*, 12, 3 (August 1998), 17–29.
50. Wade, D.; Mention, C.; and Jolly, J. *Teams: Who Needs Them and Why?* Houston, TX: Gulf Publishing, 1996.
51. Walther, J.B., and Burgoon, J.K. Relational communication in computer mediated interaction. *Human Communication Research*, 19, 1 (1992), 850–889.
52. Warkentin, M.; Sayeed, L.; and Hightower, R. Virtual teams vs. face to face teams: An exploratory study of web-based conference systems. *Decision Sciences*, 28, 4 (Fall 1997), 975–976.
53. Wellins, R.S.; Byham, W.C.; and Wilson, J.M. *Empowered Teams*. San Francisco: Jossey-Bass, 1991.
54. Zaleznik, A. Managers and leaders: Are they different? *Harvard Business Review*, 55, 3 (1977), 67–80.

Appendix A

Virtual Team Topics

Team 1: Strategic Use of Internet

Team 2: The Strategic Impact of the Internet in the Textile Sector

Team 3: Quality-Based IS Development

Team 4: Use of EIS (executive information system) in the Management of Universities

Team 5: Strength and Weaknesses of Virtual Teams

Team 6: Integration of DSS, EIS, and ES/KBS (expert system/knowledge-based system)

Team 7: Potential of Electronic Commerce

Team 8: Use of Expert Systems in the Financial Sector

Team 9: Relevance of DSS and EIS in Decision-Making

Team 10: Requirements Specification of a DSS/EIS

Team 11: Role of Intranets in the Organizations

Team 12: Strategic Planning of IS/IT in the government sector

Appendix B

Virtual Team Member Survey

Topic _____ Team # _____

Instructions: The intent of this survey is to provide feedback that will be useful in determining ways to improve the effectiveness of virtual teams. Nothing that you say in this survey will be used to evaluate either your Mexican team members or your INSEAD team leader. The survey may be completed anonymously, or you may provide your name if you prefer. We do ask that you provide the name of your team leader, as the team leaders are interested in your feedback (your name will not be available to them with the feedback).

When responding to the following questions, please think about your virtual team leader and those characteristics that have made him/her most effective. In the following questions dealing with your virtual team, the abbreviation VTL will be used for your virtual team leader. Unless otherwise indicated please circle the response that best indicates your opinion. Thank you for taking the time to provide your opinions.

Please give your virtual project team leader's name _____

1. How well would you say you know your VTL?

1	2	3	4	5
As a distant colleague				As a close colleague and personal friend

2. In terms of the overall quantity of communication between yourself and your VTL, how would you rate this in terms of quantity?

1	2	3	4	5
Far too little		Just right		Far too much

3. When you have required important information about the virtual team project, your VTL has communicated this information?

1	2	3	4	5
Not at all	In too little detail	Just right		In too much detail

4. In terms of the regularity of communication with your VTL, how would you rate this?

1	2	3	4	5
Highly regular		Somewhat regular		Very regular

5. In terms of the quality of the communication between you and your VTL, how would you rate this?

1	2	3	4	5
Not very good				Extremely good

6. When there are important changes/news concerning the project, your VTL communicated these changes:

1	2	3	4	5
Not at all				Very clearly

7. When you had important questions about the project, your VTL responded:

1	2	3	4	5
Not at all	Very late	Late	Promptly	Very promptly

8. For the following questions, please write in your response in front of the question using the following scale:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I feel very confident about the skills of my VTL.	1	2	3	4	5
b. My VTL had much knowledge about the team project.	1	2	3	4	5
c. My VTL has specialized capabilities that helped increase our performance*	1	2	3	4	5

* If you responded to c with a 4 or a 5, please indicate what these specialized capabilities are.

d. My VTL is well-qualified.	1	2	3	4	5
e. My VTL was very capable of performing his/her tasks.	1	2	3	4	5
f. My VTL showed a great deal of integrity.	1	2	3	4	5
g. I could rely on my VTL.	1	2	3	4	5
h. Overall, my VTL was very trustworthy.	1	2	3	4	5
i. My VTL was usually considerate of my opinions and ideas.	1	2	3	4	5
j. My VTL was friendly.	1	2	3	4	5
k. I have confidence in my VTL.	1	2	3	4	5
l. My VTL was usually considerate of my feelings.	1	2	3	4	5

9. To what extent were you satisfied with each of the following:

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
a. Your ability to find out about changes or news that affected your virtual team.	1	2	3	4	5
b. Your ability to get help on virtual team related problems.	1	2	3	4	5
c. Your sense of belonging to the virtual team**	1	2	3	4	5

* If you responded 1 or 2, please specify why you were not satisfied.

d. Your virtual team leader's ability to evaluate your performance*	1	2	3	4	5
---	---	---	---	---	---

* If you responded 1 or 2, please specify why you were not satisfied.

10. To what extent were the following means of communication employed on this global project?

	Never	To a Small Extent	Fairly Often	Very Often	To a Great Extent
Fax	1	2	3	4	5
E-mail	1	2	3	4	5
Face-to-face meetings	1	2	3	4	5
Telephone	1	2	3	4	5
Voice mail	1	2	3	4	5
Video conferencing	1	2	3	4	5
Conference calls	1	2	3	4	5
Web collaboration tools	1	2	3	4	5

If your team used a Web-collaboration tool, please list below the type(s) and names of the technologies used:

11. To what extent do you agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I felt certain about how much authority I had on this virtual team.	1	2	3	4	5
b. I knew what my responsibilities were on this virtual team.	1	2	3	4	5
c. I knew what was expected of me on this virtual team.	1	2	3	4	5
d. I felt that I had sufficient time to perform my responsibilities on this virtual team.	1	2	3	4	5

12. To what extent did your VTL exhibit the following characteristics:

	Almost Never	Very Seldom	Occasionally	Frequently	Almost Always
a. He/she came up with inventive ideas.	1	2	3	4	5

b. He/she experimented with new concepts and ideas.	1	2	3	4	5
c. He/she exerted influence in the virtual team.	1	2	3	4	5
d. He/she ensured that I met short-term stated goals.	1	2	3	4	5
e. He/she ensured that I met long-term stated goals.	1	2	3	4	5
f. He/she made my role very clear.	1	2	3	4	5
g. He/she clarified my priorities and directions.	1	2	3	4	5
h. He/she anticipated work flow problems and avoided crisis.	1	2	3	4	5
i. He/she brought a sense of order into my work.	1	2	3	4	5
j. He/she was in control of his/her work.	1	2	3	4	5
k. He/she compared records, reports and so on to detect any potential problems.	1	2	3	4	5
l. He/she surfaced key differences among team members and then worked to participatively solve them.	1	2	3	4	5
m. He/she encouraged participative decision making.	1	2	3	4	5
n. He/she showed empathy and concern in dealing with me.	1	2	3	4	5
o. He/she treated me in a sensitive caring way.	1	2	3	4	5

13. Finally, we would like to know your general overall assessment of the person as a managerial leader:

	Poor				Excellent
a. My virtual team project leader's performance was:	1	2	3	4	5

