Using Bibliometric Analysis to Evaluate Scientific Progress in Virtual Teams Research

Suzanne Weisband

Sherry M.B. Thatcher

Jennifer Xu

Eller College of Management

University of Arizona

Tucson, Arizona 85721

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ABSTRACT

There is an increasing number of research reviews on virtual teams, and researchers continue to probe new ways of investigating the effects of working at a distance. Yet with all this new knowledge, it is unclear what we have learned about the progress of science in the field. One way that researchers learn about a field of study like virtual teams is to review the empirical literature. But if authors tend to cite papers that are similar to their way of doing research, do we really learn anything new? How realistic, or generalizable are the results if there is no cross-fertilization of methodology? We conducted a bibliographic analysis of the virtual teams literature from 1995-2002. Our aim was to examine whether research papers on virtual teams cluster according to the type of methodology they share. A statistical testing technique, a social network analysis, and a visualization network analysis were used to test citation patterns to determine whether papers are more similar to those within the same group (i.e., same methodology) than papers from other groups (i.e., different methodology). The results show that, overall, papers using the same methodology are more similar to each other than to papers using different methodologies. There are some differences over time in that earlier papers were mostly lab experiments and later papers were mostly field studies. However, the results persist in terms of citation similarity. A discussion of the implications of our findings and for future research follows.

INTRODUCTION

Perhaps it is not surprising that there has been a recent flood of research reviews on virtual teams (Bell & Kozlowski, 2002; Martins, Gilson, & Maynard, 2004; Powell, Piccoli & Ives, 2004; Watson-Manheim, Jordan & Shumpert, 2002), given the growing prevalence of virtual teams in organizations (e.g., Gibson and Cohen, 2003) and that "virtualness" is a potential characteristic of all teams (e.g., Griffith, Sawyer & Neale, 2003). Clearly there is a need to understand the research, to define it better, and to notice the gaps or lack of coherence in virtual work structures (e.g., Watson-Manheim, Chudoba & Crowston, 2002). Yet with all this new understanding of the inputs, processes, and outputs of virtual teams (e.g., Martins et al., 2004; Powell et al., 2004), and the ever-evolving definitions of virtual teams based on the ubiquity of virtual interactions and their physical, temporal, and relational boundaries (e.g., Griffith & Neale, 2001), it is unclear what we have learned about the progress of the science in the field.

The empirical literature on virtual teams is no longer in its infancy, nor does it belong to one discipline. There are studies on virtual teams published in Accounting (e.g., Ngwenyama, 1998), Communication (e.g., Storck & Sproull, 1995; Walther, 1995; 1997), Engineering (e.g., Johansson, Dittrich & Juustila, 1999; Lind, 1999; Sosa, Eppinger, Pich, McKendrick & Stout, 2002), Human Computer Interaction (e.g., Fussell, Kraut, Lerch, Scherlis, McNally & Cadiz, 1998), Management Information Systems (e.g., Aiken & Vanjani, 1997; Burke & Chidambaram, 1999; Jarvenpaa, Knoll & Leidner, 1998), Operations Management (Bal & Foster, 2000; Pawar & Sharifi, 1997), Organizational

Behavior (e.g., Barkhi, Varghese & Pirkul, 1999; Burke, Aytes & Chidambaram, 1999; Cramton, 2001), and Psychology (e.g., Barreto & Ellemers, 2002; Hollingshead, 1998; Straus, 1996), to name a few. Researchers from different academic disciplines typically cluster into informal networks that focus on common research questions, as well as common research methods used to answer them (Burt, 1977; Blackburn & Mitchell, 1981; Culnan, O'Reilly & Chatman, 1990).

What is particularly absent from a comprehensive review of the virtual teams research is an understanding of how authors make judgments about what other research most closely relates to their own. As part of a larger study investigating the virtual teams literature from 1995-2002, this paper is an attempt to examine the degree to which research papers on virtual teams cluster according to the type of methodology they share. Kessler (1963) introduced the notion of bibliographic coupling as a measure of the citation similarity between two documents. The more two documents share common citations, the more they are related (Kessler, 1963).

While bibliographic coupling links documents that share the same citations, co-citation measures the frequency with which two documents are cited together (Small, 1973). Two papers are co-cited if there is a third paper which cites them both. Thus, co-citation is a measure of similarity between two cited papers. The advantage of bibliographic coupling for this study is that it tends to ignore the many reasons authors have for citing previous papers, focusing, instead, on the judgments made by an author as to what other papers most closely relate to his or her paper.

An example of the difference between bibliographic coupling and co-citation is shown in Figure 1. Papers *X* and *Y* have two units of bibliographic coupling between them because they each cite papers *B* and *C* (and *E*'s citing of *X* and *Y* is not considered). On the other hand, the co-citation strength of X and Y is one, since paper *E* cites both X and Y. Here, the focus is on the cited papers *X* and *Y* and the strength of that relationship.

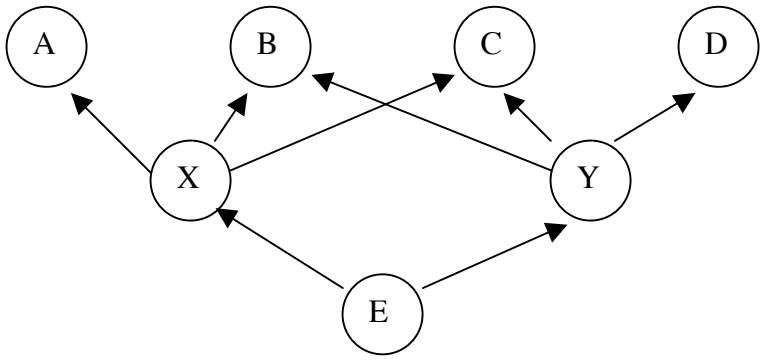

Figure 1. Citation links among papers

Given that the research conducted on virtual teams range across disciplines and methodologies, bibliographic coupling can offer a lens into the intellectual structure of the field (e.g., Culnan, 1986; McCain, 1990). The value of bibliometrics as a research methodology is based on the assumption that citations are a measure of scholarly dependence upon previous work. It is an attractive form of measurement because it is objective and unobtrusive (Garfield, 2001). Our goal in conducting a bibliometric analysis is to determine whether papers using a particular research method (e.g., laboratory experiment) cite papers using the same method, or whether they cite papers using a different research method (e.g., a field study).

In this paper, we focus on three types of research methods: (1) laboratory experiments, (2) longitudinal, or quasi-experimental studies, and (3) field studies. Laboratory experiments describe studies where independent variables are manipulated and their effects upon other variables observed (Campbell & Stanley, 1963). Lab studies occur at one period of time, whereas longitudinal studies are quasi-experimental designs that occur over time. Researchers conducting longitudinal studies have some control in how they manipulate the independent variable, but they have less control than researchers conducting lab studies. The third type of research method we investigate is broadly defined as field study. We focused on the naturalistic context of the research and less on how the data were collected. Field studies included survey research, ethnographies and other qualitative studies, as well as case studies that included multiple research methods.

The paradox of external validity

All research methods, whether conducted in a laboratory or in the field, whether employing quantitative or qualitative techniques, require trade-offs (Runkel & McGrath, 1972). They create contextual settings that have both advantages and disadvantages for contributing to knowledge that generalizes to human behavior in organizations. Is it better to have control in the laboratory but lose some of the realism of being in the field, or is it better to obtain the naturalness of the field setting at the cost of sacrificing control? "The obvious answer is that it depends. It depends on the types of trade-offs the researcher needs to make given the nature of the research problem" (Ilgen, 1986: 258).

The question pertains to the issue of external validity: generalizability from one experiment or study to other situations (Locke, 1986, Mook, 1983). Locke (1986) argues

that to achieve generalizability between laboratory and field settings on all dimensions (e.g., subjects, tasks, settings, etc.) is impossible. Just as there is no way to run a field study in the lab, it is infeasible to run a lab study in the field. "Thus, what is needed when trying to determine the legitimacy of generalization is *the identification of the essential features of field settings that need to be replicated in the lab* (Locke, 1986: 7, author's emphasis). But what is "essential" cannot be known in advance without discovering them inductively, by *investigating what has been found in studies thus far*. The virtual teams literature has developed a multitude of research methods, ranging from laboratory experiments to field studies to ethnographic studies of how people work in virtual teams. Do researchers investigating virtual teams discover what is "essential" in studies that are outside their common methodology? In particular, we ask, do researchers conducting lab studies cite papers that use qualitative data? Do field researchers cite experimental papers?

Citations in science

Scientific research involves the generation, processing, diffusion and utilization of scientific knowledge. The papers that are cited are an essential part of that knowledge; they contribute to the research discipline's common understanding of a field of study. Of course, the relationship between author and citation is unclear, mostly because we can never really know why an author cites (or does not cite) the works of others (Verbeek, Debackere, Luwel & Zimmerman, 2002). At issue is the degree to which researchers investigating virtual teams borrow from others' works. Do they cite studies outside of their research norms of practice, or do they cite research that is similar to their own? More

importantly, can science advance if authors cite papers that share the same research method as they do?

It has been shown that science can progress when there are norms of practice, with common standards and common methodologies (Lohmann, 2004; Pfeffer, 1993). It is within these "high paradigm" fields where theory is developed, hypotheses are tested, and results are accepted (Pfeffer, 1993). However, science progresses in new directions when there is some cross-fertilization across disciplines (Anderson, 1983; Locke, 1986). When authors cite papers from different disciplines, they learn about new theories and methodologies. In subsequent research, these theories can then be tested using different methodologies or in different contexts. In that way, scientific theories can be generalized, refined, or even abandoned.

The goal of this paper is to investigate the network of citations from empirical studies of virtual teams. If we find that many of the studies on virtual teams cite literature that is similar to the authors' chosen research methodology, then it may help to explain why the field has not progressed in new theoretical directions. Alternatively, we may learn that empirical studies of virtual teams cite research using different methodologies, suggesting where new theories are more likely to develop.

METHODOLOGY

As described earlier, bibliographically coupled papers form a network in which nodes represent papers and links represent relations between papers or co-cited papers. Three techniques were used to test whether authors share citation patterns with papers that use the same methodology as the author. A statistical testing technique, a social network

analysis, and a visualization network analysis were used to test whether papers are more similar to those within the same group (i.e., same methodology) than papers from other groups (i.e., different methodology).

Sample

This study is part of a larger study reviewing the empirical literature on virtual teams. We define virtual teams in two ways. First, it is a *team*, so for our research purposes, we adopt the definition of a team as three or more persons (DeSanctis, 1989; Hare, Blumberg, Davies, & Kent, 1996) who work together independently to achieve common goals (Lipnack & Stamps, 1997). We assume that team members are aware of the team as an entity and their membership on it (Arrow, McGrath, & Berdahl, 2000). Virtual teams are also physically and temporally distant, requiring that virtual team members perform the majority of their work from different locations (Lurey & Raisinghani, 2001) and use technology-supported communication substantially more than face-to-face communication (Maznevski & Chudoba, 2000).

We began our larger study by collecting titles and short descriptions or abstracts of all papers related to virtual teams from 1995 to 2002, and that were published in 16 top-tier journals in multiple disciplines, including Management, Management Information Systems, Psychology, and Communication. In addition to the 16 main journals, we extended our list of papers by searching various library databases, as well as professional distribution lists. We also used references on the papers we had collected to lead us to other related papers. In total we collected over 200 papers, however our final dataset resulted in 88 journal papers and book chapters that investigate the empirical literature on

virtual teams and fit our criteria of inclusion. The list of journals and books from which the sample is derived is presented in Appendix A. The complete list of articles included in our sample is presented in Appendix B.[1]

Figure 1 shows the breakdown of the 88 papers into the three types of methodology and over time. Overall, there were 32 (36%) experimental studies, 25 (28%) longitudinal studies, and 31 (35%) field studies. Over time, however, the data show a different picture. In the early years, between 1995-1999 (n=44), there were very few

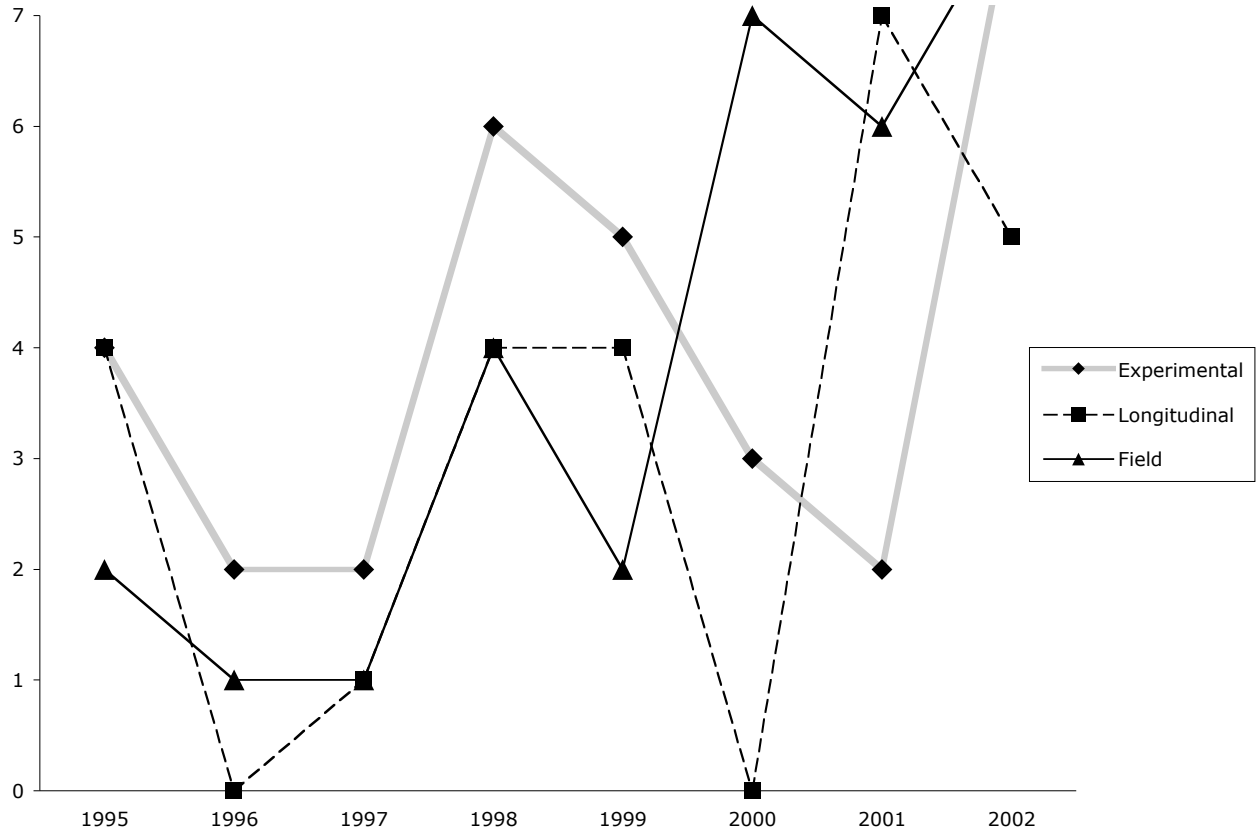

Figure 1: Sample of papers by methodology and time

[1] Our study is ongoing. The current study ended in 2002, but we are continuing to collect empirical papers through 2004.

longitudinal and field studies. In fact, during those early years, experimental studies contributed to 48% of the total number of studies in our sample (n=21). Later on, between 2000-2002 (n=44), the 21 field studies contributed to almost half of the studies conducted during that time (48%). Given the uneven distribution of papers over time, we will present the results of the citation analysis for three time periods: overall (1995-2002), early (1995-1999), and late (2000-2002).

Citation Analysis

This study is a bibliographic coupling analysis on 88 journal papers. Each paper has a set of attributes including title, authors, publication year, journal name, and papers cited. In addition, papers are categorized into three different groups based on the methodology used: field study, longitudinal, and lab experiment. In order to run our analyses we first created a citation list for each article in our sample. We then provided each citation with a unique identification code so that we could compare the citation lists of each pair of articles.

Network generation

To generate a network of the papers under study we first calculated the citation similarity between bibliographically coupled papers and used the similarity value to represent relational strength of the links in the resulting network. The idea is that two papers are related (bibliographically coupled) if their citation patterns are similar. The more overlap in their cited paper list, the more similar they are. Each paper is represented as a set consisting of a list of cited papers. For each pair of papers we calculated the cosine similarity and Jaccard similarity (Rasmussen, 1992) between the two representing

sets. Let $P_i = \{C_{1i}, C_{2i,} \ldots C_{ki}\}$ represent a paper, *i*, which cites *k* other papers, and the similarity between two papers, *i* and *j*, is defined as follows:

$$S_{Cosine}(i,j) = \frac{|P_i \bigcap P_j|}{\sqrt{k_i \times k_j}} \quad (1)$$

$$S_{Jaccard}(i,j) = \frac{|P_i \bigcap P_j|}{k_i + k_j - |P_i \bigcap P_j|} \quad (2)$$

We performed our citation analysis using three types of techniques: statistical, social network analysis, and visualization. We performed our analyses on empirical papers published between 1995–2002. We also performed analyses on papers published during early (1995-1999) and late (2000-2002) time periods.

Statistical testing technique

Treating papers using the same methodology as a group, we performed a statistical test to ascertain whether papers are more similar to citations within the same group than to citations from other groups. For each paper, we calculated the average similarity (using Cosine and Jaccard similarity measures) between the paper and other papers that use the same methodology (average within-group similarity) and the average similarity between the paper and other papers that use different methodologies (average between-group similarity).

Social network technique

Social network analysis approaches have also been employed in citation analysis studies (Giannakis & Croom, 2001; Mullins, 1980). Measures such as centrality, cohesion, and density are often used to identify influential nodes (papers or authors) and track the changes in network structures (Giannakis & Croom, 2001). A group is

considered cohesive if its members have stronger or denser relations with members in the same group than with members from other groups (Wasserman & Faust, 1994). In our study, cohesion means that papers using the same methodology (in the same group) should be more similar to each other in cited paper lists than to papers using different methodologies. In social network studies, a group is considered cohesive if its cohesion value is greater than 1.0 According to Wasserman and Faust (1994), cohesion is defined as:

$$Cohesion_G = \frac{\frac{\sum_{i \in G} \sum_{j \in G} s(i,j)}{n(n-1)}}{\frac{\sum_{i \in G} \sum_{j \notin G} s(i,j)}{N(N-n)}} \qquad (3)$$

where $G = \{P_1, P_2, \ldots P_n\}$ representing a group of n papers using the same methodology; $s(i, j)$ is the similarity between paper i and paper j; and N is the total number of papers.

Visualization network technique

A number of studies employ visualization approaches to map a citation network in a scientific field (Small, 1999). For example, multi-dimensional scaling (MDS) has been used to generate a map of a co-citation network consisting of 42 MIS researchers (Culnan, 1987). The MDS map displays which researchers are related to others based on their proximity, such that researchers who are less related are far apart. Other visualization approaches, like the spring embedder algorithms (Borner et al., 2001) and PathFinder algorithms (Chen & Paul, 200; White & McCain, 1998), have also been used in citation mapping studies.

We used MDS to visualize the citation network based on citation similarity data. Nodes represent papers. A link between two papers, say A and B, means that A and B are similar because they cite one or more papers in common. The more the cited papers overlap, the more similar the two papers are, and the closer they are on the MDS map. To keep the network from being too cluttered we show only strong links here by removing links whose similarity value is less than a threshold value of 0.10.[2]

RESULTS

Statistical Testing Technique

Table 2 presents the results of a two-tailed *t*-test performed on the 88 pairs of average values. Numbers in parentheses indicate average standard deviations. The results show that, overall, papers using the same methodology (within-group measure) are more similar to each other than to papers using different methodologies (between-group measure). The same is true for both the early and late time periods as well.

Measures	Mean of Avg. Within-Group Similarity	Mean of Avg. Between-Group Similarity
1995-2002 (Overall)		
Cosine	0.067 (0.040)	0.053** (0.026)
Jaccard	0.034 (0.021)	0.026** (0.013)
1995-1999 (Early)		
Cosine	0.079 (0.041)	0.058*** (0.026)
Jaccard	0.040 (0.024)	0.029*** (0.015)
2000-2002 (Late)		

[2] We removed 6 papers from the visualization network because their similarity value with other papers is less than 0.10. These papers are listed in Appendix B.

Cosine	0.071 (0.037)	0.057** (0.021)
Jaccard	0.035 (0.019)	0.028** (0.011)

***p<.001 **p<.01; *p<.05

Table 2. Results of Cosine and Jaccard similarity measures

Social Network Technique

Table 3 presents the cohesion values for papers within each type of methodology investigated in this research. All cohesion values (for both Cosine and Jaccard similarity measures) are greater than 1.0, supporting the findings in Table 2 that papers using the same methodologies are more similar to each other than to papers using different methodologies. Dividing the data into the different time periods reveals some differences between methodologies. Given the increased frequency of published field studies during this time, it is perhaps not surprising that field studies are slightly more likely to cite similar references in the later time period (Cosine=1.164) than in earlier time periods. Similarly, longitudinal studies are less likely to cite similar references during the later time period (Cosine=1.396) than in earlier time periods. (Since social network data are single data points, there is no way to compare these measures across both time periods and methodologies.)

Measure	Experimental Study	Longitudinal Study	Field Study
1995-2002			
Cosine	2.004	1.524	1.096
Jaccard	2.072	1.566	1.080
1995-1999			
Cosine	2.006	1.689	1.024
Jaccard	2.119	1.709	1.004

2000-2002			
Cosine	2.022	1.396	1.164
Jaccard	2.113	1.443	1.119

Table 3. Results of cohesion measures by methodology and year

Visualization Network Technique

The visualization networks are presented in Figures 2-4. The links represented by the experimental and longitudinal citations are much denser than the links represented by the field study citations. This indicates that articles using experimental and longitudinal methodologies are much more likely to have a similar citation pattern with papers using a similar methodology. In contrast, the links represented by articles using field study methodologies are sparse, suggesting that they have few similar citations with other field study papers.

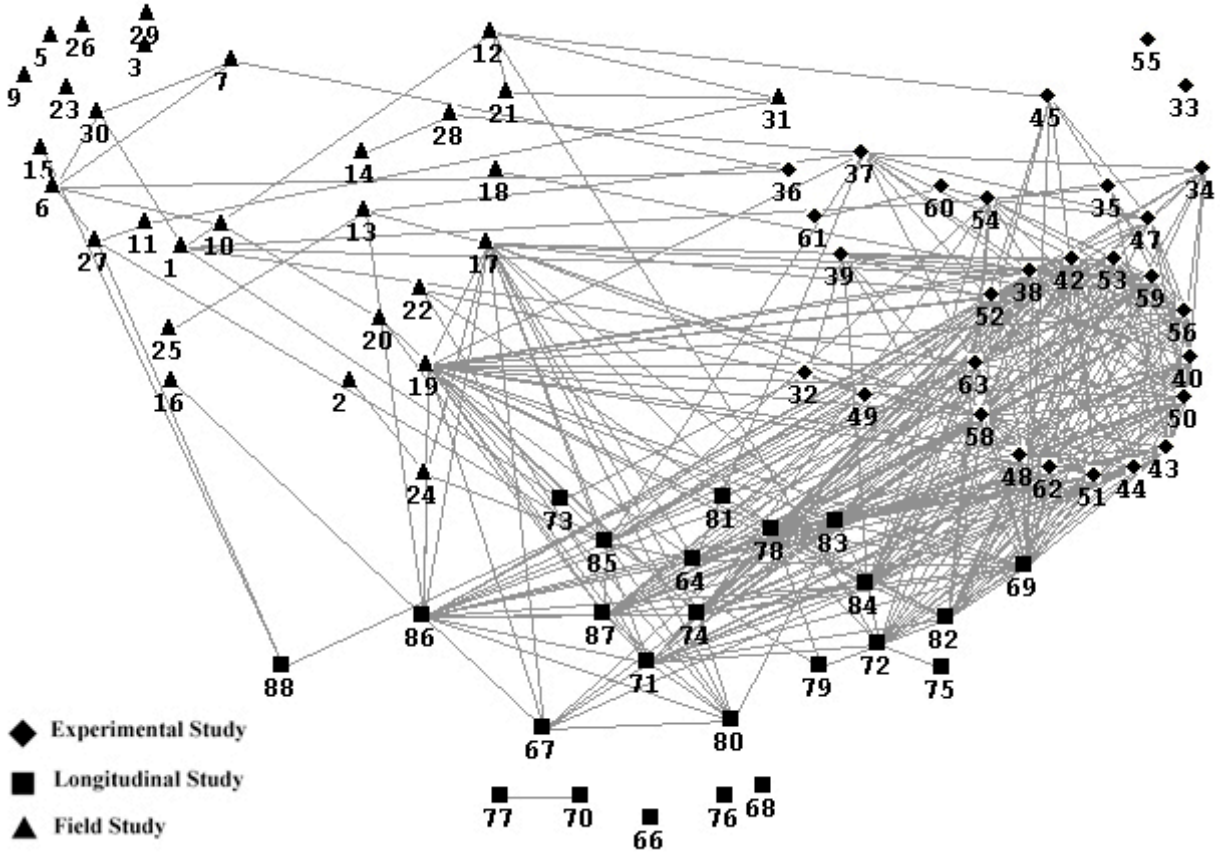

Figure 2: Overall visualization network (1995-2002)

When viewing the visualization networks by the two time periods, we see an interesting evolution of citation patterns. For the articles published in the early years,Figure 3 shows that papers using experimental methods were much more likely to have similar citation patterns. There was some overlap between experimental and longitudinal papers, but there was virtually no overlap with papers using a field study approach. Moreover, it is worth noting that there is almost no citation similarity among the 10 studies that use the field study methodology.

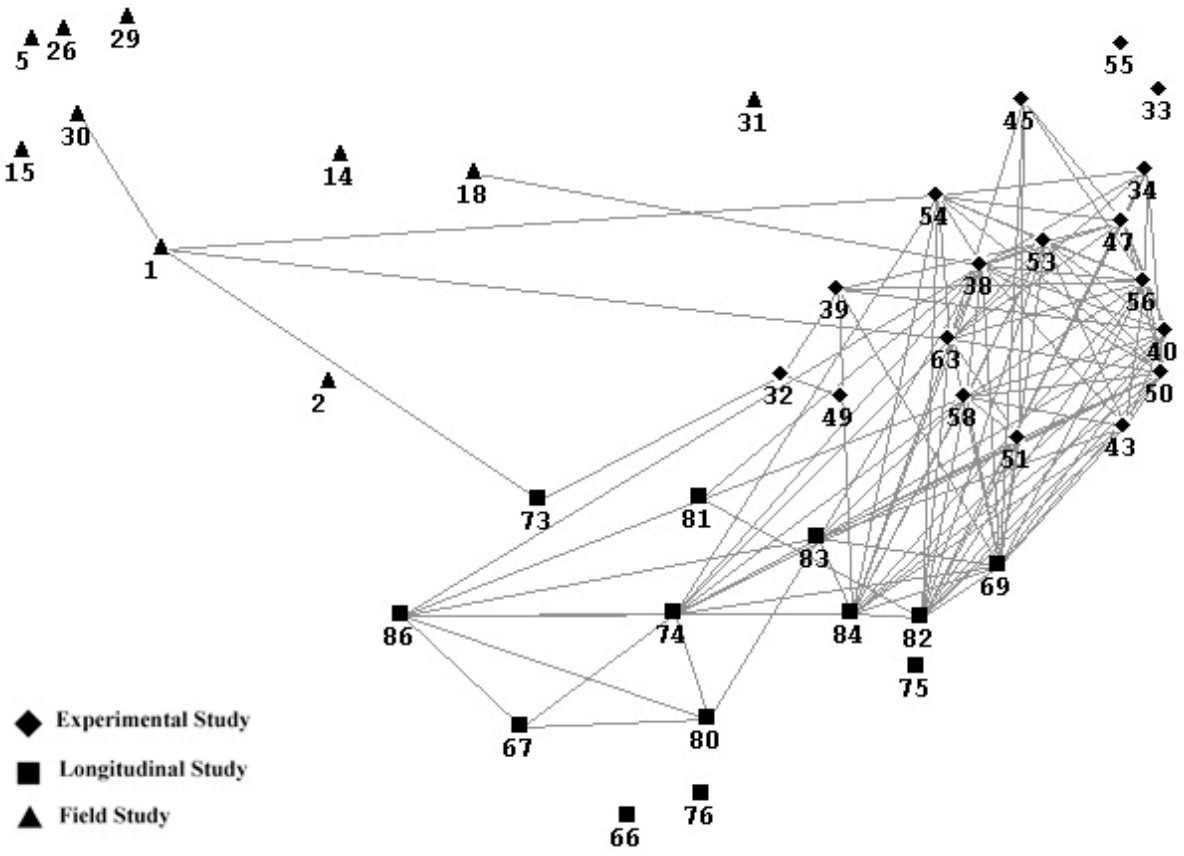

Figure 3: Early visualization network (1995-1999)

Figure 4 presents the visualization data for the late time period between 2000 and 2002. The results show that there is again a strong similarity of citations among and between papers using experimental and longitudinal methodologies. We also see that some of the papers utilizing a field study methodology are beginning to draw on some of the literature used in experimental and longitudinal studies.

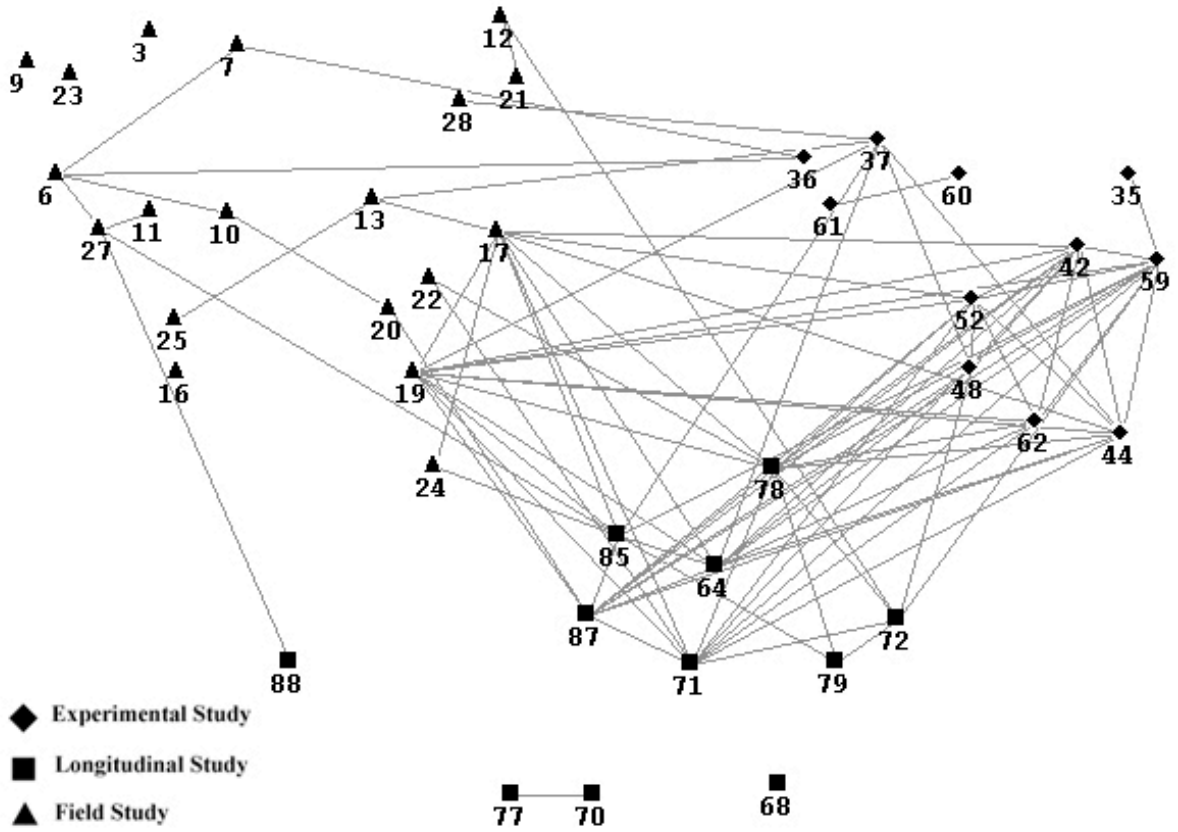

Figure 4: Late visualization network (2000-2002)

In summary, all three techniques found that papers using the same methodology are more similar in citation patterns than papers using different methodologies.

DISCUSSION

Using three techniques to investigate bibliographic citation analysis, we found that researchers employing a particular type of method to investigate virtual teams cite more papers with similar methodologies and fewer papers with different methodologies. The visualization map in Figure 2 shows that experimental and longitudinal studies have more dense citation patterns than field studies. This suggests that experimental and longitudinal studies cite papers that are similar in methodology to other experimental and longitudinal

studies. However, when the data are divided into two time periods, we see a different citation pattern in the later period from 2000-2002. The increase in the frequency of field studies published suggests that there might be more cross-fertilization of citation patterns represented by the less density shown in the visualization map (see Figure 4). We are encouraged by these findings as it suggests that more recent field research studying virtual teams are citing papers with multiple methodologies.

We began this paper with the claim made by Locke (1986) that to determine the legitimacy of generalization is to identify the "essential features" of field settings and replicate them in the lab. Our data suggest, at least so far, that researchers conducting laboratory experiments of virtual teams are not citing (and reading) the field research, as much as field researchers are citing the experimental literature. Given the increased number of field studies reported recently, there is likely to be some very exciting experimental (and longitudinal) research that can come from this work. In other words, science progresses when the citation patterns among researchers conducting field, experimental, and longitudinal studies indicate that there is an ongoing relationship. It is only by this process of sharing and integrating results that scientific progress will be made.

The three methods we discussed here (experimental, longitudinal, and field studies) provide great value in helping us understand virtual teams research from multiple perspectives. Our research continues as we collect empirical research on virtual teams through 2004. In this way, we can examine whether the field is moving in new theoretical directions by examining the citation patterns, as well as the theoretical content and findings from this research. For now, there is enough evidence to recommend that

researchers investigating the virtual teams literature read papers from multiple disciplines and methodologies. In this way, new theories can be developed, tested, and refined, and the field as a whole will move in exciting, new directions.

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APENDIX A: Journals, Conference Proceedings, and Books Used to Gather Initial List of Virtual Teams Research, 1995-2002.

Main journals used in original search:

1. Academy of Management Journal (AMJ)
2. Communications of The Association for Computing Machinery (CACM)
3. Decision Sciences
4. Group Decision and Negotiation (GDN)
5. Human Communication Research (HCR)
6. Human Computer Interaction (HCI)
7. IEEE Transactions on Professional Communication
8. Information and Management
9. Information Systems Research (ISR)
10. Journal of Management Information Systems (JMIS)
11. Journal of Personality and Social Psychology (JPSP)
12. Management Information Systems Quarterly (MISQ)
13. Management Science (MS)
14. Organizational Behavior and Human Decision Processes (OBHDP)
15. Organization Science (OS)
16. Small Group Research (SGR)

Journals/conference proceedings included in the second round of search:

17. Accounting, Management and Information Technologies
18. ACM Special Interest Group on Groups (SIGGROUP)
19. British Journal of Management
20. Computer-Supported Cooperative Work (CSCW)Proceedings
21. Ergonomics
22. IEEE Transactions on Engineering Management
23. Information Systems Journal
24. Information Technology and People (ITP)
25. International Journal of Conflict Management (IJCM)
26. International Journal of Organizational Analysis
27. International Journal of Production Economics
28. International Journal of Production Research
29. Journal of Product Innovation and Management (JPIM)
30. MIT Sloan Management Review
31. Research-Technology Management

Books included in the second round of search:

32. Distributed Work
33. Diversity in Work Teams: Research Paradigms for a Changing Workplace
34. The Virtual Workplace

APPENDIX B: Article list (Alphabetical by Author)

#	Authors	Journal / Book Title	Year	Article Title
45	Aiken & Vanjani	Information & Management	1997	A comparison of synchronous and virtual legislative session groups faced with an idea generation task
1	Armstrong & Cole	BC: Diversity in work teams: Research paradigms for a changing workplace, Ch. 8	1995	Managing distances and differences in geographically distributed work groups
8	Armstrong & Peter	BC: Distributed Work, Ch. 7	2002	Virtual proximity, real teams
33	Arrow	Journal of Personality and Social Psychology	1997	Stability, bi-stability and instability in small grou influence patterns
21	Bal & Foster	International Journal of Production Research	2000	Managing the virtual team and controlling effectiveness
43	Barkhi, Varghese & Pirkul	Group Decision and Negotiation	1999	An experimental analysis of face to face versus computer mediated communication channels
61	Barreto & Ellemers	Small Group Research	2002	The impact of anonymity and group identificatio on progroup behavior in computer-mediated groups
5	Bellotti & Bly	Computer-Supported Cooperative Work	1996	Walking away from the desktop computer: Distributed collaboration and mobility in a product design team
36	Bradner & Mark	Computer-Supported Cooperative Work	2002	Why distance matters: Effects on cooperation, persuasion and deception
71	Burke, Chidambaram & Aytes	Group Decision and Negotiation	2002	Do some things change faster than others? The dynamics of behavioral change in computer-supported groups
69	Burke & Chidambaram	Group Decision and Negotiation	1995	Developmental differences between distributed and face-to-face groups in electronically supported meeting environments: An exploratory investigation
83	Burke & Chidambaram	MIS Quarterly	1999	How much bandwidth is enough? A longitudina examination of media characteristics and group outcomes
58	Burke, Aytes, Chidambaram & Johnson	Small Group Research	1999	A study of partially distributed work groups: The impact of media, location and time on perceptions and performance
78	Burke, Aytes & Chidambaram.	Information Technology and People	2001	Media effects on the development of cohesion and process satisfaction in computer supported workgroups: An analysis of results from two longitudinal studies
22	Carletta, Anderson & McEwan	Ergonomics	2000	The effects of multimedia communication technology on non-collocated teams: A case study
85	Cramton	Organization Science	2001	The mutual knowledge problem and its consequences for dispersed collaboration

46	Dennis & Kinney	Information Systems Research	1998	Testing media richness theory in the new media: the effects of cues, feedback and task equivocali
57	Dennis, Kinney & Hung	Small Group Research	1999	Gender differences in the effects of media richness
4	Dube & Pare	Communications of the ACM	2001	Global virtual teams
35	Farnham, Chesley, McGhee & Kawal	Computer-Supported Cooperative Work	2000	Structured online interactions: Improving the decision-making of small discussion groups
66	Fussell, Kraut, Lerch, Scherlis, McNally & Cadiz	Computer-Supported Cooperative Work	1998	Coordination, overload and team performance: Effects of team communication strategies
15	Goodman & Darr	MIS Quarterly	1998	Computer-aided systems and communities: mechanisms for organizational learning in distributed environments
23	Govindarajan & Gupta	MIT Sloan Management Review	2001	Building an effective global business team
63	Graetz, Boyle, Kimble, Thompson & Garloch	Small Group Research	1998	Information sharing in face to face teleconferencing, and electronic chat group
30	Grinter, Herbsleb & Perry	SIGGROUP	1999	The geography of coordination: Dealing with distance in R&D work
7	Handel & Herbsleb	Computer-Supported Cooperative Work	2002	What is chat doing in the workplace?
40	Harmon	Group Decision and Negotiation	1998	Electronic meetings and intense group conflict: Effects of a policy-modeling performance suppor system and an audio communication support system on satisfaction and agreement
53	Harmon, Schneer & Hoffman	Organizational Behavior and Human Decision Processes	1995	Electronic meetings and established decision groups: Audioconferencing effects on performance and structural stability
54	Hedlund, Ilgen & Hollenbeck	Organizational Behavior and Human Decision Processes	1998	Decision accuracy in computer-mediated versus face-to-face decision-making teams
47	Hightower & Sayeed	Information Systems Research	1996	Effects of communication mode and prediscussion information distribution characteristics on information exchange in grou
34	Hightower, Sayeed, Warketin & McHaney	BC: The Virtual Workplace, Ch. 11	1998	Information exchange in virtual work groups
87	Hobman, Bordia & Irmer	Small Group Research	2002	The expression of conflict in computer-mediated and face-to-face groups
49	Hollingshead	Journal of Personality and Social Psychology	1998	Retrieval processes in transactive memory systems
80	Jarvenpaa, Knoll & Leidner	Journal of Management Information Systems	1998	Is anybody out there? Antecedents of trust in global virtual teams
86	Jarvenpaa &	Organization Science	1999	Communication and trust in global virtual teams

	Leidner			
76	Johansson, Dittrich & Juustila	IEEE Transactions on Professional Communication	1999	Software engineering across boundaries: Student project in distributed collaboration
6	Jones & Hinds	Computer-Supported Cooperative Work	2002	Extreme work teams: Using SWAT teams as a model for coordinating distributed robots
50	Kahai & Cooper	Journal of Management Information Systems	1999	The effect of computer-mediated communicatior on agreement and acceptance
79	Kayworth & Leidner	Journal of Management Information Systems	2001	Leadership effectiveness in global virtual teams
72	Kim, Hiltz & Turoff	Group Decision and Negotiation	2002	Coordination structures and system restrictivenes in distributed group support systems
67	Knoll & Jarvenpaa	BC: The Virtual Workplace, Ch. 1	1998	Working together in global virtual teams
3	Kock	Communications of the ACM	2000	Benefits for virtual organizations from distributed groups
75	Lind, M. R.	IEEE Transactions on Professional Communication	1999	The gender impact of temporary virtual work groups
12	Lurey & Raisinghani	Information and Management	2001	An empirical study of best practices in virtual teams
24	Majchrzak, Rice, Malhotra, King & Ba	MIS Quarterly	2000	Technology adaptation: The case of a computer-supported inter-organizational virtual team
16	Malhotra, Majchrzak, Carman & Lott	MIS Quarterly	2001	Radical innovation without co-location: A case study at Boeing Rocketdyne.
9	Mark	BC: Distributed Work, Ch. 11	2002	Conventions for coordinating electronic distributed work: A longitudinal study of groupware use
32	Marshall & Novick	Information Technology and People	1995	Conversational effectiveness in multimedia communications
65	Massey, Montoya-Weiss, Hung & Ramesh	Communications of the ACM	2001	Cultural perceptions of task-technology fit
17	Maznevski & Chudoba	Organization Science	2000	Bridging space over time: Global virtual team dynamics and effectiveness
13	McDonough, Kahn & Barczak	Journal of Product Innovation & Management	2001	An investigation of the use of global, virtual, and colocated new product development teams
25	McDonough & Cedrone	Research-Technology Management	2000	Meeting the challenge of global team management
42	Mennecke, Valacich & Wheeler	Group Decision and Negotiation	2000	The effects of media and task on user performance: A test of the task-media fit hypothesis
64	Montoya-Weiss, Massey & Song	Academy of Management Journal	2001	Getting it together: Temporal coordination and conflict management in global virtual teams
55	Moore, Kurtzberg, Thompson &	Organizational Behavior and Human Decision Processes	1999	Long and short routes to success in electronically mediated negotiations: group affiliations and

	Morris			good vibrations
20	Mortensen & Hinds	The International Journal of Conflict Management	2001	Conflict and shared identity in geographically distributed teams
10	Mortensen & Hinds	BC: Distributed Work, Ch. 12	2002	Fuzzy teams: Boundary disagreements in distributed and collocated teams
2	Ngwenyama	Accounting, Management, and Information Technologies	1998	Groupware, social action and organizational emergence: On the process of dynamics of computer mediated distributed work
82	Ocker, Hiltz, Turoff & Fjermestad	Journal of Management Information Systems	1995	The effects of distributed group support and process structuring on software requirements development teams: Results on creativity and quality
81	Ocker, Fjermestad, Hiltz & Johnson	Journal of Management Information Systems	1998	Effects of four modes of group communication o the outcomes of software requirements determination
26	Pawar & Sharifi	International Journal of Production Economics	1997	Physical or virtual team collocation: Does it matter?
39	Rao	Group Decision and Negotiation	1995	Effects of teleconferencing technologies. An exploration of comprehensions feedback, satisfaction and role-relative differences.
19	Rasters, Vissers & Dankbaar	Small Group Research	2002	An inside look: Rich communication through lea media in a virtual research team
11	Robey & Khoo	IEEE Transactions on Professional Communication	2000	Situated learning in cross-functional virtual team
70	Rutkowski, Vogel, Bemelmans & Van Genuchten	Group Decision and Negotiation	2002	Group support systems and virtual collaboration The HKNET project
37	Schmidt, Montoya-Weiss & Massey	Decision Sciences	2001	New product development decision-making effectiveness: Comparing individuals, face-to-fac teams, and virtual teams
41	Sheffield	Group Decision and Negotiation	1995	The effect of communication medium on negotiation performance
48	Sia, Tan & Wei	Information Systems Research	2002	Group polarization and computer-mediated communication cues, social presence, and anonymity
27	Sole & Edmondson	British Journal of Management	2002	Situated knowledge and learning in dispersed teams
28	Sosa, Eppinger, Pich, McKendrick & Stout	IEEE Transactions on Engineering Management	2002	Factors that influence technical communication in distributed product development: An empirica study in the telecommunications industry
60	Spears, Lea, Corneliussen, Postmes & Haar	Small Group Research	2002	Computer-mediated communication as a channe for social resistance: The strategic side of SIDE
73	Storck & Sproull	Human Communication Research	1995	Through a glass darkly: What people learn in videoconferences.
56	Straus	Small Group Research 1996	1996	Getting a clue: The effects of communication

				media and information distribution on participation and performance in computer-mediated and face-to-face groups
31	Suchan & Hayzak	Computer-Supported Cooperative Work	1998	The communication characteristics of virtual teams: A case study
51	Tan, Wei, Watson, Clapper & McLean	Management Science	1998	Computer-mediated communication and majorit influence: Assessing the impact in an individualistic and a collectivistic culture.
44	Tan, Wei, Huang & Ng	IEEE Transactions on Professional Communication	2000	A dialogue technique to enhance electronic communication in virtual teams
62	Topi, Valacich & Rao	Small Group Research	2002	The effects of personality and media differences on the performance of dyads addressing a cognitive conflict task
14	Van den Bulte & Moenart	Management Science	1998	The effects of R&D team co-location on communication patterns among R&D, marketing and manufacturing
29	Vickery, Clark & Carlson	Information Systems Journal	1999	Virtual positions: an examination of structure an performance in ad hoc workgroups
77	Vogel, van Genuchten, Lou, Verveen, van Eekout & Adams	IEEE Transactions on Professional Communication	2001	Exploratory research on the role of national and professional cultures in a distributed learning project
84	Walther	Organization Science	1995	Relational aspects of computer mediated communication: experimental observations over time
74	Walther	Human Communication Research	1997	Group and interpersonal effects in international computer mediated collaboration
38	Warkentin, Sayeed & Hightower	Decision Sciences	1997	Virtual teams vs. FTF teams: An exploratory stud of a web-based conference system
68	Weisband	BC: Distributed Work, Ch. 13	2002	Maintaining awareness in distributed team collaboration: Implications for leadership and performance
52	Yoo & Alavi	MIS Quarterly	2001	Media and group cohesion: Relative influence o social presence, task participation and group consensus.
88	Yoo & Kanawattanachai	The International Journal of Organizational Analysis	2001	Developments of transactive memory systems ar collective mind in virtual teams
18	Zack & McKenney	Organization Science	1995	Social context and interaction in ongoing computer-supported management groups.
59	Zornoza, Ripoll & Peiro	Small Group Research	2002	Conflict management in groups that work in two different communication contexts: Face-to-face and computer-mediated communication