Incorporating Virtual Teamwork Training into MIS Curricula

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ABSTRACT

Due to increasing industry demand for personnel who work effectively in virtual/distributed teams, MIS students should undergo training to improve their awareness of and competence in virtual teamwork. This paper proposes a model for virtual teamwork training and describes the implementation of the model in a class where students were located in two separate geographical locations. Both survey and qualitative data suggests that the class increased students' awareness of and competence in virtual teamwork. Potential improvements to the course design are also discussed.

Keywords: virtual team, distributed team, virtual teamwork, virtual teamwork training, MIS curriculum

1. INTRODUCTION

Over the past decade, advancements in IT have driven an escalating industry trend toward the use of virtual teams to carry out virtual/distributed projects (Evaristo and Fenema 1999; Powell, Piccoli and Ives 2004). Evidence of this trend is the expanding market for "distributed" or "collaborative" project management software. According to a recent report, the market for distributed project management software is expected to increase from nearly 1 billion annually in 2002 to nearly 7.2 billion by 2007 (Collaborative Strategies 2004).

In many cases, people use the terms virtual team and distributed team interchangeably. While both terms refer to the teams that rely heavily on computer-mediated communication (CMC), distributed teams have members who are geographically dispersed while a virtual team's members may be very close to one another. Virtuality can be viewed as a continuum with the amount of virtuality measured by the degree of dependence on CMC (Cohen and Gibson, 2003). A team that relies entirely on CMC is more virtual than the one that relies on a mix of face-to-face (FtF) communication and CMC for its interaction. If two teams rely on CMC to the same degree, the team with members on different continents is more highly distributed, but no more virtual than the team with members residing entirely within the same city or located on the same campus.

Whereas a team is defined as a group of people working toward a common goal, teamwork refers to the process that the team employs to achieve that goal. It includes any individual or group activities that team members engage in towards completion of the team's objective. In this paper, virtual teamwork is defined as teamwork conducted via CMC regardless of team members' geographical location. Whereas a distributed team will almost certainly need to engage in virtual teamwork to complete its team goal, a collocated team may also need to engage in some amount of virtual teamwork due to team members' dispersion among different floors or buildings and the difficulties of scheduling FtF meetings.

Virtual teams provides a variety of potential benefits to organizations by allowing them to secure resources from multiple locations, reduce travel expenses, and possibly generate synergy amongst diverse team members. Furthermore, virtual teamwork allows team members to work from anywhere and anytime that technology permits. As a result, virtual teams and virtual teamwork are pervasive

organizational phenomenon. In fact, virtual teams and teamwork are becoming the norm and not the exception (Willmore, 2003, p. 5) Being able to engage in effective virtual teamwork is therefore an important vocational skill for IS professionals and knowledge workers in general.

However, due to difficulties involved in communication and coordination, engaging in effective virtual teamwork is not an easy task (Bourgault, Lefebvre, Lefebvre, Pellerin and Elia 2002; Jonsson, Novosel, Lillieskold and Eriksson 2001; Powell et al., 2004). Because nonverbal or para-verbal communication cues are often absent from CMC, virtual team members may experience difficulty interpreting the meaning of messages and non-reply from their team members (Bordia, 1997; Crampton, 2001). In turn, degraded comprehension and increased misunderstanding results in group discussion, negotiation, and consensus building processes that are lengthy and ineffective in comparison to similar FtF interactions (Powell et al., 2004). Prior research has established that collocated teams regularly outperform virtual teams in regards to effective planning and efficient exchange of information (DeMeyer, 1991; Galegher and Kraut, 1994; Powell et al., 2004). Collocated teams may also develop strong interpersonal relationships more readily than virtual teams (Walther, 1996).

A number of researchers have suggested interventions that can be employed to improve interpersonal relationship building and the overall performance of virtual teams. Suggested interventions include team building exercises (Kaiser, Tullar and McKowen, 2000), establishment of shared norms (Sarker, Lau and Sahay, 2001; Suchan and Hayzak, 2001), specification of a clear team structure (Kaiser et al., 2000), using FtF interaction at the project planning stage (Ramesh and Dennis, 2002), setting explicit team goals (Kaiser et al., 2000; Kayworth and Leidner, 2000), strengthening team members' technical expertise (Sarker, et. al. 2001; Jarvenpaa and Leidner, 1999), and engaging in timely, predictable, and frequent communication (Jarvenpaa and Leidner, 1999; Weisband, 2002). Even though it is more challenging to conduct successful virtual teamwork than collocated teamwork, researchers have reported that, across a wide variety of virtual teamwork dimensions, training will improve team members' ability to succeed in a virtual environment. In fact, Powell and his colleagues (Powell et al., 2004) suggest that nearly any type of virtual teamwork training benefits the team.

Assuming that new MIS graduates have acquired sufficient skill at school, or expecting that they will obtain virtual teamwork skills via trail and error while engaging in virtual teamwork, employers may assign new employees into virtual teams without any advance training. If the employees have not acquired adequate virtual teamwork skills at school, it is likely that they will repeat common mistakes that might easily be avoided. Both students and employer would benefit from an MIS curriculum that incorporates virtual teamwork training.

Unfortunately, the current approach to virtual teamwork training in MIS curriculum is largely ad hoc, There are several reasons for this phenomenon. First, MIS instructors may feel that the topic of virtual teamwork is not important. Second, the MIS curriculum is already crowded with traditional knowledge bodies and there is little room for new content. Third, instructors may not be comfortable teaching the topic due to their limited experience and the limited availability of textbooks with sufficient coverage of virtual teamwork. Consequently, MIS instructors may not cover the topic of virtual teamwork at all or may only cover the topic in a one or two-hour lecture without a project by which students can apply their virtual teamwork knowledge to actual practice. Without practical application, student learning remains at the conceptual level with only limited breadth and depth of understanding.

In a number of cases, instructors have incorporate virtual projects into their classes more for the research opportunity rather than for instructional purposes (e.g., Jarvenpaa and Leidner, 1999; Massey, Montoya-Weiss and Hung, 2002; Weisband, 2002; Paul, Seetharaman, Samarah and Mykytyn, 2005; Qureshi, Liu and Vogel, 2005; Sarker and Grewal, 2002; Sutanto, Phang, Kuan, Kankanhalli and Tan, 2005, Beranek and Martz, 2005). In other words, the researchers or instructors required students to engage in virtual projects as part of a course because they wanted to investigate various phenomena of virtual teamwork itself. Because training in virtual teamwork may not have been a primary concern, the instructors may have implemented virtual projects without an explicit, planned objective for improving students' ability to perform in a virtual environment. Consequently, student learning may not have been maximized due to a lack of both structure and active intervention from their instructors. Moreover, the instructors may have failed to adequately document their valuable teaching experiences, reflect upon them, or share them with colleagues in the format of publication. As a result, even though a number of teaching cases have accumulated over the years, virtual teamwork training is still practiced using a piecemeal rather than systematic approach.

The first challenge to creating a systematic training approach is to find a way to fit the topic of virtual teamwork training into the existing MIS curricula. According to Rollier (2002), MIS curricula are already crowded with courses and it is difficult to add a new educational component. Moreover, a relatively rigid curriculum structure often prevents MIS programs from responding to labor market realities in a timely and flexible manner (Rollier, 2002). To address the challenge of fitting new content into existing curricula, Rollier (2002) proposed a short-run strategy called "double duty" course design. This strategy attempts to "find techniques for satisfying multiple learning objectives in the same time period". Following Rollier's recommendations, we suggest that instructors teach virtual teamwork within existing MIS courses that have a project component such as software development, systems configuration or case analysis. The dual objectives of virtualized projects are 1) to provide students with hands-on experience within a particular MIS subject area (e.g., System Analysis and Design, Database, Data Communication), and 2) simultaneously increase students' awareness of and competence in virtual teamwork. Awareness of virtual teamwork refers to students' knowledge of effective and ineffective virtual teamwork practices and the factors that contribute to the effectiveness or ineffectiveness of such practices. Competence in virtual teamwork refers to skill in employing that knowledge in practice.

The primary objective of our study is to propose a systematic approach in the form of a model or strategy for

virtual teamwork training that can be used to increase students' awareness of and competence in performing virtual teamwork. Our model will address several key issues: the first is to specify how to teach; the second is to identify what to teach; and the third is to suggest how to assess the learning outcome.

The balance of the paper is organized as follows: Section 2 introduces the model and its theoretical foundations; Section 3 presents our research methodology and describes how our model was implemented. In Section 4 we discuss our experiences with the implementation of the model and in Section 5 we briefly discuss our findings, contributions, limitations, and directions for future research.

2. VIRTUAL TEAMWORK TRAINING MODEL AND ITS THEORETICAL FOUNDATIONS

Among a variety of learning theories, Kolb's (1984) learning cycle (figure 1) is particularly relevant to our study. The learning cycle consists of four sequential processes (concrete experience, observational reflection, abstraction conceptualization, and active experimentation) that reinforce one another and collectively contribute to learning. For example, consider a virtual team engaged in a project. After team members have been engaged in various project tasks for some time (concrete experience), they find that their collaboration has not been effective (observational reflection). They then analyze the situation and develop hypotheses to explain their poor performance (abstraction conceptualization). Finally they determine that one of the major reasons for their poor performance is ineffective communication; in particular, that some team members have either not checked and replied to email in a timely manner or have not carefully read email messages and responded accordingly. The team then formulates guidelines for effective communication and implements the new rules (active experimentation). If performance improves, the learning cycle is complete. If not, the learning cycle needs to be repeated.

Our training model for virtual teamwork is derived from and embodies Kolb's (1984) learning cycle. As Kolb (1984) pointed out, learners do not have to start with concrete experience. In other words, they do not have to learn everything from scratch but can learn from other people's experiences. For students to learn effective and ineffective virtual teamwork practices that have been experienced and summarized by others (abstraction conceptualization), instructors can give well-organized lectures, prescribe informative readings materials, and encourage students to engage in team discussion about the topic.

Once students have gained some familiarity with virtual teamwork in the introductory stages of the class, the instructor may then engage students in a project in a real or simulated virtual project for several weeks. During project execution, when students follow the dictates of known best practices, they learn through the process of active experimentation. When they are unaware of any heuristics or rules, they learn through the process of concrete experience or trial and error. Students thus internalize their conceptual knowledge through active participation. The teaching approach for this stage is focused on designing a virtual teamwork task having an appropriate level of project complexity and task interdependence such that team members are forced to engage in serious virtual collaboration to complete the project. Moreover, to maximize students' learning, the instructor should design exercises that allow students to contemplate what has happened (observational reflection), and identify lessons learned (abstract conceptualization). Effective teaching approaches include activities that encourage students to summarize and articulate their experiences. Examples include focused team discussion, team report writing, and discussion via online forums.

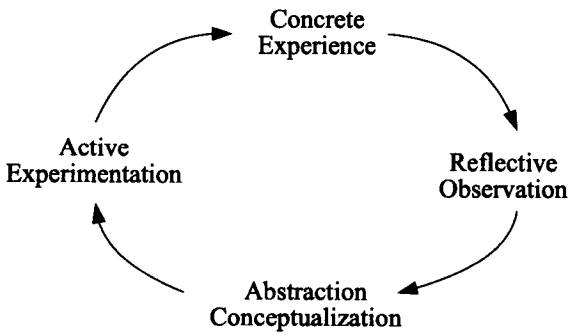

Figure 1 Learning Cycle from Kolb (1984)

After the project has been completed, the instructor will need to assess whether the learning objectives have been achieved. The instructor can assess student content learning outcomes by grading the project deliverables, and assess their virtual teamwork learning through surveys, report writing, and online forum discussion. The instructor can then use these assessments to improve teaching in future classes.

Powell and his colleagues (Powell et al., 2004) suggest that nearly any type of virtual teamwork training benefits the team. However, an ad hoc approach of selecting training topics could be time-consuming and ineffective for instructors with little virtual teamwork experience. With the goal that it will provide some guidance for instructors in searching for and organizing their teaching materials, we propose a simple framework that classifies the major aspects of a variety of training topics.

From our literature review we have identified three closely related topics that promote understanding of virtual teamwork environments: traditional collocated teamwork, virtual teamwork, and CMC. There is little doubt that collocated teamwork is the foundation of virtual teamwork and that virtual team members need to understand the basic processes and phenomenon associated with collocated teamwork. These processes include team building (e.g.,"form, storm, norm, and perform" - Tuckman, 1965), interpersonal relationship building (e.g., building trust and group cohesion), types of team conflicts (relationship conflict, task conflict, and process conflict - Griffith, Mannix and Neale, 2003), techniques to solve conflict (e.g., confrontation vs. avoidance), tasks interdependence, team structure, and team collaboration. In addition to understanding collocated teamwork, virtual team members need to know how to address additional issues in virtual teamwork that arise due to geographical separation; time zone variation, language disparity, organizational and cultural differences, and technology incompatibilities (Hinds and Weisband, 2003).

Learning Process	Learning Techniques	Teaching approach
Abstraction Conceptualization – (Conceptual Learning at the Beginning of the Class)	Students learn by reading, listening, and discussing the following knowledge areas • Face-to-face teamwork • Virtual teamwork • Computer mediated communication (CMC)	The instructor supplies relevant reading material, gives well-organized and informative lectures, and encourages teams to discuss relevant materials.
Active Experimentation and **Concrete Experience** -(Learning by Doing the Project)	Students learn by doing the following activities • Engaging virtual teamwork by following the known effective practice • Engaging virtual teamwork by trial and error	The instructor designs the virtual teamwork with appropriate level of project complexity and task interdependence so that team members have to engage in serious virtual collaboration to complete the project.
Observational Reflection – (Learning by Reflecting on Project Execution)	Students learn by reflecting and discussing effective/ineffective virtual team practices	The instructor encourages individual and group reflection via team discussion, team report writing, and online forum discussion.

Table 1 Model of Virtual Teamwork Training

cultural differences, and technology incompatibilities (Hinds and Weisband, 2003).

Among a host of virtual teamwork skills, one of the most significant is CMC, the indispensable technology for team collaboration and team interpersonal relationship building (Jarvenpaa & Leidner, 1999; Powell, et al., 2004). Communication can often make or break the virtual work. As stated by Hoefling (2001, p. 103) "virtual work is supported or derailed often because of communication habits, patterns, and processes." To collaborate efficiently and effectively, virtual team members need to be aware of the available CMC technologies and how these technologies can be used effectively to support different tasks (e.g., brainstorming vs. discussion) and different communication modes (e.g., synchronous-distributed vs. asynchronous-distributed). Table 1 summarizes our training model.

In summary, this model of virtual teamwork training provides a framework for class design and highlights the theoretical foundation of that design. We implemented this model in a graduate level course in enterprise systems configuration and tested the effectiveness and usefulness of both the model and its implementation.

3. RESEARCH METHODOLOGY AND IMPLEMENTATION OF THE TRAINING MODEL

This study used a case study approach. Case study is appropriate when investigators want to study a phenomenon in its context, or when current understanding of the phenomenon is limited and the investigators would like to obtain an in-depth understanding of it (Yin, 1994). Both criteria apply to our study. Since we have very limited understanding of virtual teamwork training in the classroom, we would like to gain an initial, in-depth understanding of how our design works in practice.

3.1 Class Design

Two aspects of class design - team member dispersion and level of project complexity - warrant additional emphasis. Ideally, individual team members need to be located in geographically dispersed locations so they will be forced to rely heavily on CMC for team collaboration. However, if team members are at the same location, artificial constraints may be imposed on student teams to increase their reliance on CMC and create a higher degree of virtuality. For example, instead of assigning only three members to a team, the instructor may want to assign five members to a team. Larger teams are likely to have tight or conflicting schedules and therefore will have reduced opportunity to meet FtF. Larger teams should thus exhibit increased use of CMC.

Choosing an appropriate level of project complexity is also important since it is likely that students won't learn much from a project that is either too simple or overly complex. When the project is too simple, close collaboration may not be needed. When the project is overly complex, students may become overwhelmed by task details and fail to learn effective collaboration. Three major factors contribute to project complexity: scope, novelty, and task interdependency. Larger projects are typically perceived as more complex than smaller projects. Projects involving new technologies or significant learning are likewise perceived as more complex than projects involving older technologies and existing knowledge. Finally, projects with high tasks interdependency tend to be perceived as more complex than projects with low tasks interdependency.

Task interdependency can be visualized as a continuum ranging from completely independent to highly interdependent (Thompson, 1967; Van De Ven, Delbecq and Koenig, 1976). In order to create opportunities for students to collaborate, highly interdependent tasks should be used for the class project. These tasks should involve problem solving, discussion, negotiation, and group consensus building; all of which require simultaneous involvement by a majority of the team members.

3.2 Implementation of the Training Model

We implemented the training model in a professional MBA class with students from two locations (L1 and L2) separated by approximately 75 miles. Some students were IT professionals, and others were not, however, the class design and content were typical for a graduate level MIS course. Among the 21 students in the class, 12 were female and 9 were male. The average age of the students was 37.5, and the average of number of years working full-time was 13.9. The class was delivered in a condensed session which spanned an 8-week summer session. Students were required to learn about the structure and functions of an information system in an organization environment by configuring SAP software for an imaginary company. SAP R/3 is an Enterprise Resource Planning (ERP) system designed to support a full

spectrum of business functions (e.g., accounting, finance, sales, manufacturing, human resources, etc.). The objective of the course was for students to experience and learn how an integrated enterprise-wide information system supports business processes across the various functional areas of an organization.

The MBA class consisted of 21 students and was divided into six teams. Each team was responsible for an individual functional area and all teams working closely with one another to make the system work. The six teams were designated as: Financial (FF), Controlling (CO), Sales and Distribution (SD), Material Management (MM), Procurement (PP), and Human Resources (HR). At the first class meeting students were assigned a role within a fictitious company, such as inventory manager, sales manager, accountant, etc. Team membership was then determined by the role that each student was assigned. In addition, each team was assigned of one member from location L1 with the balance of the team from L2. At the end of the 3rd week of class, the L1 member of the SD team dropped the class. This resulted in only 20 students completing the course and in SD team becoming collocated. Even though the L2 team members lived in the same general area, they were all employed full-time and had very limited time to meet FtF. All teams needed to rely heavily on CMC for collaboration.

The final deliverable for the class was a single functional SAP instance and documentation of the software configuration. This project was considered complex because (1) a typical semester's work-load (sixteen weeks) was condensed into eight weeks; (2) most students had no prior experience working with the SAP system; and (3) every team worked to configure only a portion of the overall integrated system and thus team task interdependence was very high. The high level of project complexity created ample opportunity for teams to engage in serious collaboration. To further motivate students to engage in virtual teamwork, an overall class grade for the project contributed 50% towards the individual students' final grades.

Class was held weekly on Saturdays only; 9:00am – noon was scheduled for lecture/discussion, and lab activities were scheduled for 1pm – 4pm. The instructor for the class alternated between the two locations, holding class one Saturday at L1 and the next at L2. When class was taught at one location, students in the other location gathered in a multi-media classroom and viewed the class via video broadcast.

Due to the tight schedule for the class, the instructor only spent half of the first lecture (1½ hours) reviewing virtual teamwork and spent the balance of the lecture time announcing the predetermined team assignments, explaining the project, and distributing instructional material for using GroupSystems II (GSII), a Web-based groupware tool that can be used for virtual team collaboration. Students spent most of the first two weeks acquiring SAP knowledge and forming their teams. The remaining six weeks were spent engaged in the group exercise. In addition to the teams of students, the instructor appointed an assistant (from outside the class) to function as project manager for the class as a whole. The project manager had previously completed a similar class and was expected to be knowledgeable about SAP configuration and have the ability to consult with the students regarding their configuration decisions.

To facilitate students' reflection about their virtual team experiences, the instructor set up an online discussion forum on WebCT so that students could anonymously record individual comments and suggestions regarding the project. In addition, the instructor required each team to write a final report detailing their virtual teamwork experiences and providing feedback about the class in general.

3.3 Data Collection

We collected both quantitative and qualitative data via surveys, students' individual comments on the WebCT online forum, and the final team reports. Students filled out an online survey in the first week before they started their teamwork. They filled out a follow-up survey in the seventh week. Team reports were collected at the end of the seventh week as well. Students were informed that their input on the surveys and group report would neither help nor hurt their grade in the class.

4. RESULTS

All 21 students filled out the initial survey, however, only 17 of the 20 students who completed the course filled out the second survey. Therefore only the data from 17 sets of observations have been included in statistical analysis which follows. Most questions on both of the surveys used 7-point Likert-type scales, with one (1) indicating strongly disagree, and seven (7) indicating strongly agree. Some of the questions were common to both surveys. These common questionnaire items were used to assess whether students' perceptions changed over the course of the 8-weeks.

A possible concern for our study is that our virtual teams were only partially distributed teams with one remote member and the remaining members collocated. This may lead the reader to question the degree of virtuality involved in the project and thus question the overall usefulness of our observations. In our second survey, we employed the questionnaire item "My team were heavy users of computer-mediated communication." The mean of response to this item was 6 out of 7. We also asked each student to estimate how many minutes they spent engaging with each of a number of commonly used communication media. The average number of minutes reported for the individual media were as follows: FtF (563 minutes), Yahoo! Groups (421 minutes), telephone (378 minutes), email (285 minutes), WebCT (246 minutes), Instant Messenger (19 minutes), other CMC (14 minutes). Total communication media usage averaged 1926 minutes (32.1 hours) with 563 minutes (9.4 hours or 30%) attributed to FtF communication. Although the students' estimates may only be rough approximations, they nonetheless provide a coarse grained picture of media usage. Teams reported relying on CMC for 70% of their teamwork collaboration. This degree of CMC use would undoubtedly offer sufficient opportunity for virtual teamwork learning to occur.

4.1 Perception of the Importance of Virtual Teamwork Training

Two questions on survey 1 were used to assess students' opinions regarding the importance of virtual team training for an MIS curriculum. Students indicated they believed that virtual teamwork training is an important component (Mean

= 6, SD = 0.88), and that training in virtual teamwork is necessary for a person who has no virtual teamwork experience but will be working on a virtual team (Mean = 5.53, SD = 1.26).

4.2 Usefulness of the Class

Four questions on survey 2 were used to assess students' perception of the usefulness of the class. Students slightly or moderately agreed that the class increased their understanding of virtual teamwork (Mean = 6.0, SD = 0.75), that the class enhanced their ability to work in a virtual team environment (Mean = 5.65, SD = 1.49), that the class was useful in preparing them to work in virtual team environment (Mean = 5.59, SD = 1.38), and that they learned how to work effectively in virtual team environment (Mean = 5.47, SD = 0.39).

Five questions common to both surveys were used to estimate whether the class actually increased students' awareness of virtual teamwork and competence to work in a virtual team environment. Since the sample size was not large and we did not make the assumption of normal distribution of the data, we think a non-parametric test such as the Wilcoxon signed ranks test or sign test is more appropriate than a parametric test such as a paired-t test. The Wilcoxon signed ranks test assumes a symmetric population probability distribution and we did not make that assumption. We therefore we used the sign test to analyze our paired data. The comparison of students' understanding of virtual teamwork environment before and after taking the class illustrated that the class significantly increased their awareness of and competence in performing virtual teamwork. Students reported that coordination challenges were greater in virtual teamwork than collocated teamwork (Mean = 4.53 vs. 6.12; Z = 0.002); that they had a better understanding of good and bad practices in virtual teamwork (Mean = 4.47 vs. 6; Z <0.001), that their basic understanding of virtual teamwork had improved (Mean = 4.12 vs. 5.82; Z < 0.001), and that they could more effectively use CMC tools (Mean = 5.76 vs. 6.24; Z = 0.06, Z value is approaching significance level, which is .05). Students indicated that they had a good understanding of the benefits and challenges of virtual teams at the beginning of the class (Mean = 6), and this perception did not change appreciably by the end of the course.

Qualitative data supported the survey data and provided more insight into what students learned from their virtual teamwork. All teams except SD (which is the only team to have all team members in one location after losing the team member from) reported that the class increased their awareness of and competence in performing virtual teamwork. SD stated that "this project did not necessarily add skills with respect to competence of distributed teamwork. This was due, in large part, to the lack of control we had over several basic functions: project scope, project management, and knowledge/skills development." However, even the SD team admitted that although the project did not teach them "what to do", it did teach them "what not to do". The following quotations are examples of teams' comments regarding the usefulness of the class.

> "*The distributed project increased our competence of how to complete projects in a simulated virtual environment. We learned how to be more effective in communicating ideas by using new tools, such as Solution Manager and teleconferencing. We also became more aware of how our actions affected not only our team, but the work of other groups. We became more effective in our distributed teamwork, many times by learning from our mistakes and/or how our actions affected other members and groups.*" (MM)

> "*I do believe that this project increased both my awareness and competence of distributed teamwork... If I were to ever have the need again to work within the confines of a distributed team, I would be more knowledgeable about team nuances.*" (HR)

> "*We feel that each of us became more aware of what it takes for a distributed team to succeed (i.e. online tools, communication, and collaboration)... Our communication skills increased throughout the class... Our use of the various tools at our disposal also became more effective with the passing of time.*" (FI)

4.3 Learning from Virtual Teamwork

Students stated that they acquired important knowledge and skills for working in virtual teams. The following discussion lists the major items reported.

4.3.1 Team building activities: Students learned that team building activities were important for their performance. This professional MBA cohort had taken four classes over the prior 11 months and this class was their fifth. Therefore students were already familiar with one another to some extent. Nonetheless, four out of six teams (PP, SD, FI, HR) engaged in team building activities before starting project-specific tasks and later reflected that the team building activities were significant in facilitating their virtual teamwork. Team HR reported that team building activities allowed team members to get to "know each other better", helped to "develop greater trust and confidence" among team members, and provided "emotional/educational/practical support" for each other. Team PP stated that the team building activity established familiarity and comfort which laid a "foundation of trust" and "minimized misunderstandings or miscommunications". Team FI indicated that team building activities "built [a] platform of trust", nurtured "easy, open, confident communication" and turned "sure failure into success". Overall, team building activities enhanced team performance.

Team MM and CO did not engage in team building activities before starting their teamwork tasks and both teams later stated that they should have done so. Team MM reported that they "missed an opportunity to get to know each other, and an opportunity to decide how to best use each other's strengths, and compensate for any possible weaknesses." Team CO skipped the team building activities because they "underestimated how vital it is to know about our team member's experience or interests. These are important, because they can provide resources for solving a problem or enriching the final solution."

4.3.2 Communication and communication technologies: During the first two weeks of the semester, team members

attempted to get familiar with one another by posting personal information (e.g., educational background, work experience, hobbies, contact information, etc) on GSII. However, due to slow response times when using GSII from home and also due to its limited functionality, students switched to Yahoo! Groups from the third week and used it as a communication tool for the remainder of the semester. Each team created a folder on Yahoo! Groups in order to upload and share documents with other teams. One limitation of Yahoo! Groups is that it has a 30 MB limit on file storage. At times, teams had to either delete older files to make room for new files, or store new files on another media such as WebCT. Team members could also send email from within Yahoo! Groups to each other's principal email addresses. One student volunteered to act as the Yahoo! Groups administrator for the class. In addition to Yahoo! Groups, the teams also used email, telephone calls, and both Web and audio conferencing. Moreover, the instructor posted a variety of course materials on WebCT. In addition, the SAP Solution Manager implementation tools were used to create a central repository for all project related documents such as the project charter and standards, meeting agendas, team deliverables, testing plans, etc.

Student reports and online comments indicated that they learned to communicate effectively in two major aspects: First, teams realized that leaner communication media such as email and electronic message boards such Yahoo! Groups are effective for non-equivocal tasks (e.g., simple announcements and information exchange), whereas richer media such as phone calls or audio conferences are necessary for equivocal tasks such as clarification, negotiation, and discussion. For example, team PP used WebCT email to exchange "non-urgent, non-collaborative information," and used Yahoo! Groups "to communicate with members of other teams for problems and to alert them to changes in our team schedule." The team "spent many hours in conference calls throughout the project to coordinate with other team or group members". Near the end of the project, team members met FtF to troubleshoot the most pressing problems. The team commented that "the combination created an appropriate blend between the conveniences and efficiency of distributed communication and the quality of interactions found in traditional communication."

Team CO mainly used email, conference calls (*FreeConferenceCalls.com)*, and Yahoo! Groups. They used email "to set up appointments for conference calls and to provide project status updates among team members." They also used email for file sharing. However, the team found that it was not effective to discuss technical issues via email due to the unpredictable and sometimes lengthy time lapse between inquiry and response. In addition, there were difficulties in describing via email complicated questions or problems which might involve multiple variables. Team CO found that an effective way to resolve technical issues was talk over the phone while simultaneously interacting with the SAP system on both ends of the conversation. A useful method for sharing information asynchronously was to "create screen shots to show where a person has been, and what the results were". The examples provided by the PP and CO teams illustrated that teams used different technologies in different situation to achieve both communication efficiency and effectiveness.

Second, teams learned the necessity of forming routines or norms for communication. Team CO quickly formed a routine of using the "reply to all" e-mail function, and team members used it even without a substantive reply simply to acknowledge receipt of one another's email. This routine increased communication predictability and fostered more timely communication. In addition to day-to-day communication, all teams established a regular schedule of group interaction via FtF and/or phone conferencing. Team CO used a weekly conference call involving every team member to clarify confusion and discuss issues that needed to be resolved or tasks that needed to be completed that week. Team FI initiated a weekly conference call with team SD, and it soon expanded to include the entire class. HR established a routine of FtF meetings on every Tuesday with one remote member dialing in to participate. This meeting also expanded to include participants from other teams.

In summary, teams worked around the constraint of limited FtF meetings and reported (1) that regular, timely, and frequent communication within and across teams was important and (2) that distributed communication was effective. The following comments illustrate these points.

> *"The distributed communication was very effective and sufficient"... "Because we all have full-time jobs and many responsibilities outside of school, the ability to communicate and solve problems 'a-synchronistically' was especially helpful. On more than one occasion, we posted a problem as a Yahoo Group e-mail in the evening only to find it posted as solved in the morning."...* (FI)

> *"Distributed communication was effective. I was the team member that lived outside of the ...area and I always felt well informed about the team's progress."* (HR)

Even though students did not ask for a list of available CMC media at the beginning of the class, the instructor felt it would have been useful to provide such a list so that teams were not left to search for CMC technologies on their own and perhaps miss an opportunity to use an appropriate, effective, or inexpensive media. The following table summarizes communication media used by this class including WebEx and two group calendaring programs that were not used by this class but had been recommended to students in previous classes.

4.3.3 Other good practices and critical success factors in virtual team environment: A number of additional good practices or critical success factors for virtual teamwork were identified in the team reports. Teams CO, HR and PP suggested that team members should keep a positive attitude toward other team members and teamwork itself and should maintaining commitment to successful completion of the project. Team PP reported: *"The attitude of the teammembers [was] a critical success factor. Everyone, even when frustrated, was still striving for success."* Teams FI, HR and SD recommended that teams provide structures or processes for assigning and completing team activities (including a set meeting schedule) and maintain accountability by keeping close track of progress towards task completion.

Communications Media	Major Advantages	Major Disadvantages
Email & Listserv	• Free • Easy to use	• Comm. only in text; • Difficult to locate a file if too many email files sent
Telephone & audio conferencing	• Provide voice comm.., good for equivocal tasks such as discussion	• No file sharing capacity; • No visual cues; • Long distance phone calls incurring charges
WebCT	• Free • Courseware providing * well-organized archiving and file sharing * email function * online forum	• Comm. only in text
Yahoo! Groups (Yahoo.com)	• Free • Providing well-organized archiving and file sharing • Providing email function • No need to install any extra software	• Comm. only in text • 30 MB limit for storage capacity
FreeConferenceCalls. Com	• Web conferencing providing * multi-party voice comm.. by using regular or cell phone * well-organized archiving and file sharing * application sharing (e.g., people from different locations can edit the same document) • No need to install any extra software	Long distance phone call expense
WebEx (WebEx.com)	• Web conferencing providing * free multi-party voice comm.. by using regular or cell phone * well-organized archiving and file sharing * application sharing • No need to install any extra software	Monthly service charge
GSII (Groupsystems.com)	• Groupware providing * archiving and file sharing * email function * online chat * electronic brainstorming * online survey * structured message posting	• Comm. only in text • Need to purchase and install the software
Google Calendar	• Free group calendaring	
Officecalendar.com	• Group Calendaring for Microsoft Outlook	• Need to purchase a license to use it

Table 2 Software for Virtual Teamwork

Teams HR and FI suggested that a team needed "*shared situational awareness*" to be successful.

Four teams (MM, SD, CO and HR) reported that it was important to develop an an atmosphere of mutual support and respect among team members. Team SD reportred that they should have had "an agreement that any team member can perform any of the team's work as long as that work is documented and communicated," and that they "wasted valuable time trying not to step on toes." Team MM reflected that "the most critical success factor for [the] team was that we were all willing to help wherever and whenever we were needed, without regard to whose team area the help was needed in."

Obviously, the above suggestions apply to any form of teamwork. However, in a virtual teamwork environment, adopting best practices may be even more critical.

4.3.4 Practices that could be improved in virtual team environment: Teams identified several things that they might have done differently to improve team communication and collaboration. Team CO reported that they should have explored "the possibility of an inexpensive video conferencing set-up…" and "using the internet for voice communications and document sharing." Team FI echoed that advice by suggesting that teams should use a single asynchronous messaging and document sharing tool (one that would ideally combine the best features of both WebCT and Yahoo! Groups) and should use a synchronous Internet conferencing tool such as WebEx. Team MM reported that they should have started using audio-conferencing instead of two-party phone calls from the very beginning of the project because audio-conferencing allowed all team members to communicate at the same time. Team PP suggested that it would have been helpful to schedule an FtF meeting in the middle of the project to help solve difficult or lingering problems. Finally, team FI suggested that it would have been helpful to use some way to heighten awareness of team members' day-to-day activities in addition to their week-to-week activities.

4.4 Students' Feedback on Class and Project

All teams reported that the SAP configuration project was somewhat complex for the virtual team environment and that the project involved a relatively high level of uncertainty and ambiguity as well. They felt that the instructor did not provide sufficient information and guidance for completing the project, and that the "outside" project manager did not do his job. Subsequent to a death in the family during the second week of class, the project manager often failed to attend class meetings, responded to email sporadically, and, in general, provided inadequate assistance to the teams. The instructor attempted to compensate for the lack of overall project management but there were several miscommunications along the way. As a result, students spent a lot of time trying to figure out what they needed to do.

> *"One of the largest problems we faced was the lack of project direction and the inability to get many of those questions answered. Project management was virtually nonexistent and created a vast amount of confusion and uncertainty as we moved through the project phases."* (CO)

> *"Since our class project manager was not able to participate, we were "flying blind", especially early in the project."* (FI)

Due to the high level of complexity, uncertainty, and students' lack of virtual team experience, it was not a surprise that students reported becoming frustrated with the class at some point during the project. Despite their frustration, students reported that they remained motivated. Two survey questions were used to estimate students' motivation: "I intended to make this project a success" (Mean = 6.59, SD = 0.15); and "I was motivated to do well on this project and worked very hard to make the project a success" (Mean = 5.94, SD = 0.28). Furthermore, the class did not cause students to form a more negative attitude toward courses that require virtual teamwork. We asked students whether they liked classes that require virtual teamwork and on both surveys their mean response was 4.82. Another indicator of class success was the degree to which team members reported satisfaction with their team's performance and deliverables (Mean = 6.12, SD = 0.15).

> *"We are confident that the FI team will meet this goal"* of *"SAP configuration"*. *"Another of our goals was the successful implementation of a virtual team, and that goal was a complete success."*. (FI)

> *"The team achieved the team goal. The team deliverables and performance were excellent considering all of the circumstances."* (HR)

Furthermore, students appreciated the fact that this class allowed them to work closely with students in another location and still retain the sense of being one team. "While many of us felt frustrated at times by the uncertainty of our progress, in many ways we found it brought us together closer as a group and as a class." (MM) "...we felt communication and personal connections were enhanced throughout this class. We believe that was due to the common goal of implementing SAP as a larger team" (SD). The course instructor observed that the project deliverables produced by the current class (i.e. the functional system and documentation) were as good as those produced in earlier semesters by collocated students who were not operating as virtual teams.

4.5 Reflection about the Model and its Implementation

We proposed a model for virtual teamwork training and implemented the model in a class with a condensed summer schedule lasting only eight weeks. In the introduction stage, the instructor discussed concepts and effective practices in three areas: collocated teamwork, virtual teamwork, and CMC. Due to the condensed schedule, this introduction was very brief; the instructor spent only 1.5 hour of lecture on these topics and did not require students to read supporting materials other than PowerPoint lecture notes. None of students reported having insufficient knowledge to start their virtual teamwork, yet when students responded to the questionnaire item which read "At the beginning of the term, the instructor introduced basic concepts of teamwork, virtual teamwork, and computer-mediated communications. That information was very helpful," the mean response was 4.18. In other words, students did not think the introduction was particularly useful.

The noncommittal response regarding the usefulness of an introduction to virtual teamwork concepts may have several possible explanations. First, conceptual learning of virtual teamwork concepts before engaging in actual teamwork may not be as important as we expected. Second, the instructor may have revealed so little information about virtual teamwork that students did not perceive it to be useful. Third, the students in this class were a group of older, relatively mature individuals with multiple years of full-time working experience including extensive collocated teamwork experience. Therefore, it may have been easy for them to apply or transfer their collocated teamwork knowledge to a virtual team environment.

If the first explanation is accurate, instructors would be able to skip the introduction stage of the model entirely. We suspect, however, that this is not the case and that explanations two and three are more plausible. If the second explanation is valid, then the instructor should spend more time in the instruction stage covering virtual teamwork concepts in greater depth. If the third explanation is right, then the instructor may need to assess students' collocated teamwork experience before deciding how much virtual team information needs to be presented in the introduction stage. The instructor may need to cover introductory material in great depth for undergraduate students while a lighter coverage may suffice for graduate students. Reasons for such a low perceived usefulness of the introduction to virtual teamwork should be addressed in future studies. However, our study suggests that instruction in virtual teamwork at the conceptual level without actual engagement in a virtual project is not an effective training approach. In other words, learning by abstraction conceptualization alone (e.g., learning by reading, listening, and discussion) has significant limitation.

The second stage of our model is project execution. Here students spent six weeks engaged in virtual teamwork and it was during which time that most of their learning occurred. Students' feedback and the instructor's observations confirm our hypothesis that, in order to

maximize student learning, it is critical for the instructor to design a virtual project with an appropriate level of task interdependency and project complexity. If project complexity for this class had been somewhat reduced, students may have experienced less frustration, spent more time on actual teamwork, and had a more enjoyable learning experience. When there is little room to adjust project complexity, the instructor should carefully structure the class and provide increased guidance to reduce ambiguity and uncertainty. Especially at the beginning of this project, our teams were not sure how to proceed, what their deliverables would look like, and how their work processes and outcomes were related to those of other teams. This high level of ambiguity and uncertainty created an initial sense of bewilderment and frustration for many of the students. If the instructor assigned a project manager to supervise and coordinate the teams' efforts, the project manager should have sufficient domain knowledge to be able to clarify students' understanding and should direct project execution in an effective manner.

In addition to experiential learning, students engaged in serious contemplation and provided numerous insights regarding their experiences (observational reflection & abstraction conceptualization). Both the online forum discussion and team reports proved to be useful vehicles for engaging students in critical thinking about their learning experiences.

5. DISCUSSION

Virtual teams and virtual projects are increasingly common due to advancement in information and communications technology and MIS students should be prepared to work in virtual environments. To integrate systematic virtual teamwork training into the MIS curriculum, we developed a virtual teamwork training approach consisting of three major components. The first component is a double-duty design strategy that adds virtual teamwork training to existing curriculum without changing the curriculum structure. For example, MIS instructors can incorporate virtual teamwork training in existing course such as Database Management, System Analysis and Design, and Data Communication. The second component is a teaching model that supports Kolb's four learning processes and therefore multiple learning modes. Students learn by reading, listening to lectures, and group discussion during the introduction stage and they learn by doing the project and reflecting on their experiences during project execution. The third component is a simple method to assess students' learning experiences. We employed two simple surveys to determine whether students increased their awareness of and competence in performing virtual teamwork as a result of class participation (see Appendix for surveys). In addition, we were able to gain a more in-depth understanding of students' experiences through the group report requirement. In short, this teaching approach offers a systematic and practical, theory-based approach to virtual teamwork training.

The implementation of the teaching model was mostly a success. Even though the class project was somewhat complex and involved a high level of uncertainty and ambiguity, teams were nonetheless motivated and worked very hard to produce a functional system. Both quantitative and qualitative data support our conclusion that the class was useful and effective in increasing students' awareness of and competence in performing virtual teamwork. Students gained a better understanding of effective and ineffective virtual teamwork practices and learned how to use a variety of CMC technologies for team collaboration.

The observations and conclusions from this study should, however, be interpreted in light of several limitations. Even though we did measure some aspects of students' awareness of and competence in virtual teamwork, the study did not utilize a comprehensive, validated survey instrument to measure these phenomena. Without validated measures, our argument that the class was useful in terms of increasing students' competence in virtual teamwork is not as persuasive as it might be. In addition, this study was based on a case study involving a single MBA class. Thus, generalizing the results to other learning environments is problematic.

We missed an opportunity to ask our students whether they believed that virtual teams should be introduced in other courses or to a broader range of students. Their responses to such a question would, at least from the student viewpoint, give us insight into the importance of having virtual teamwork training in MIS curricula. We also might have asked for student feedback regarding double-duty course design. We asked our students whether the class increased their competence in virtual teamwork but we did not ask whether they thought they might be able to learn more or learn better in a collocated class rather than a distributed class. Our class was a naturally distributed or partially distributed class, i.e., the distribution of students between the two locations was not artificially created for this research. If other instructors want to implement double-duty design for their classes, they need to carefully structure the class so that the learning is not degraded by adding the virtual teamwork training component.

Although our virtual teams were not operated in a purely virtual manner, we believe this is a strength rather than weakness of the study because it is common to see teams collaborate using a combination of FtF interaction and CMC rather than exclusively FtF or through CMC alone. Virtual teamwork training does not have to be accomplished in a purely virtual environment. If so, however, an argument can be made that we have already built group projects and group interactions into MIS curricula and thus virtual teamwork training is unnecessary. If we do not provide a purely virtual environment in which to carry out virtual teamwork training, what is the difference between a regular group project and a virtual teamwork training project? The principal difference is that instructors explicitly design the virtual teamwork training class so that virtual collaboration via CMC is an integral and significant component of team projects, and instructors provide reading materials and lectures about virtual teamwork. If the class involves global virtual teams, as may be the case when Universities on different continents cooperate on a class offering, then students have may also have the opportunity to learn how to handle issues arising from differences in languages, culture, and time zone.

Despite potential limitations, our study contributes to the IS teaching practice by proposing that virtual teamwork training be incorporated into existing MIS curriculum

following Rollier's "double duty" course design methodology. Furthermore we develop and propose a training model based on Kolb's (1984) learning cycle and provide practical tips for implementing the model. We also outline our use of simple measures to assess the degree to which student competence has increased as a result of participation in a class containing a virtual teamwork training component.

In this study, our teams were not global virtual teams and did not confront time zone differences, language barriers, or cultural differences. Thus, our students learned very little, if anything at all, about how to handle these difficulties. In future research we plan to incorporate global virtual teams into a training implementation. Another future research task will be to develop a more comprehensive, validated instrument to measure awareness of and competence in virtual teamwork. Instructors would then have confidence in using such an instrument to measure the effectiveness of their own virtual teamwork training. Managers in organization might also use the instrument to select individuals with strong virtual team competence for virtual projects or to identify the need for virtual teamwork training before actually tasking team members with performing on critical projects in a real-world virtual teamwork environment.

6. REFERENCES

Beranek, M. P. and Martz, B. (2005), "Making Virtual Teams More Effective: Improving Relational Links." Team Performance Management. Vol. 11, No. 5/6, pp. 200-212.

Bordia, P. (1997), "Face-to-Face Versus Computer-Mediated Communication: A Synthesis of the Experimental Literature." The Journal of Business Communication. Vol. 34, No. 1, pp. 99-120.

Bourgault, M., Lefebvre, L., Lefebvre, L. A., Pellerin, R. and Elia, E. (2002), "Discussion of Metrics for Distributed Project Management: Preliminary Findings." Proceedings of the 35th Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Cohen, S. G., and Gibson, C. B. (2003), "Chapter 1, In the Beginning: Introduction and Framework". in Virtual Teams that Work: Creating Conditions for Virtual Team Effectiveness, C.B. Gibson and Cohen, S.G. Cohen (eds). Jossey-Bass, San Francisco, CA.

Collaborative Strategies (2004), "Executive Summary-Distributed Project Management: A Marketplace and Software Vendor Analysis," and "Executive Summary-Distributed Project Management: Update 2002." Accessed on Jan. 2005 http://www.collaborate.com/announcements/announce_3.html

Crampton, C. (2001), "The Mutual Knowledge Problem and Its' Consequences for Dispersed Collaboration." Organization Science. Vol.12, No. 3, pp. 346-371.

DeMeyer, A. (1991), "Tech Talk: How Managers Are Stimulating Global R&D Communication." Sloan Management Review. Vol. 32, pp. 49-59.

Evaristo, R. and Fenema, P. C. V. (1999), "A Typology of Project Management: Emergence and Evolution of New Forms", International Journal of Project Management, Vol. 17, No. 5, pp. 275-281.

Galegher, J. and Kraut, R. E. (1994), "Computer-Mediated Communication for Intellectual Teamwork: An Experiment in Group Writing." Information Systems Research. Vol. 5, No. 2, pp. 110-138.

Griffith, T. L., Mannix, E. A., Neale, M. A. (2003), "Chapter Fifteen: Conflict and Virtual Teams". in Virtual Teams that Work: Creating Conditions for Virtual Team Effectiveness. C. B. Gibson and Cohen, S.G. Cohen (eds). Jossey-Bass, San Francisco, CA.

Hinds, P. J. and Weisband S. P. (2003), "Chapter Two: Knowledge Sharing and Shared Understanding" in Virtual Teams that Work: Creating Conditions for Virtual Team Effectiveness. C. B. Gibson and Cohen, S.G. Cohen (eds). Jossey-Bass, San Francisco, CA.

Hoefling, T. (2001), "Working Virtually: Managing People for Successful Virtual Teams and Organizations." Stylus Publishing, LLC, Sterling, Virginia.

Jarvenpaa, S. L. and Leidner D. E. (1999), "Communication and Trust in Global Virtual Teams", Organization Science, Vol. 10, No. 6, pp.791-815

Jonsson, N., Novosel, D., Lillieskold, J. and Eriksson, M. (2001), "Successful Management of Complex, Multinational R&D Projects". Proceedings of 34th Hawaii International Conference on Systems Sciences, Maui, Hawaii, IEEE Computer Press.

Kaiser, P., Tullar, W., McKowen, D. (2000), "Student Team Projects by Internet." Business Communication Quarterly. Vol. 63, No. 4, pp. 75-82.

Kayworth, T. and Leidner, D. (2000), "The Global Virtual Manager: A Prescription for Success." European Management Journal. Vol. 18, No. 2, pp. 183-194.

Massey, A. P., Montoya-Weiss, M., and Hung, Y.-T. C. (2002), "Synchronizing Pace in Asynchronous Global Virtual Project Teams". Proceedings of the 35th Annual Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Paul, S., Seetharaman, P., Samarah, I., and Mykytyn, P. Jr. (2005), "Understanding Conflicts in Virtual Teams: An Experimental Investigation Using Content Analysis." Proceedings of the 38th Annual Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Powell, A., Piccoli, G. and Ives, B. (2004), "Virtual Teams: A Review of Current Literature and Directions for Future Research." Database for Advances in Information Systems, Vol. 35, No. 1, pp. 6 – 36.

Qureshi, S., Liu M., and Vogel, D. (2005), "A Grounded Theory Analysis of E-Collaboration Effects for Distributed Project Management". Proceedings of the 38th Annual Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Ramesh, V. and Dennis, A. (2002), "The Objected-oriented Team: Lessons for Teams Virtual from Global Software Development". Proceedings of the Thirty-Fifth Annual Hawaii International Confence on System Sciences.

Rollier, B. (2002), "Preparing MIS Students for a Global Economy", Journal of Information Systems Education, Vol. 12, No. 4, pp. 193 - 199.

Sarker, S., Lau, F., Sahay, S. (2001), "Using an Adapted Grounded Theory Approach for Inductive Theory Building about Virtual Team Development." Database for Advances in Information Systems. Vol. 32, No.1, pp.38-56.

Sarker, S. and Grewal, R. (2002), "Emergence of Leaders in Virtual Teams: What Matters?" Proceedings of the 35th Annual Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Suchan, J. and Hayzak, G. (2001), "The Communication Characteristics of Virtual Teams: A Case Study." IEEE Transactions on Professional Communication. Vol. 44, No.3, pp. 174-186.

Sutanto, J., Phang, C. W., Kuan, H. H., Kankanhalli, A. and Tan, C. Y. (2005), "Vicious and Virtuous Cycles in Global Virtual Team Role Coordination". Proceedings of the 38th Annual Hawaii International Conference on System Sciences, Hawaii, IEEE Computer Society.

Tuckman, B. W. (1965), "Developmental Sequence in Small Groups," Psychological Bulletin, Vol. 63, No. 6, pp. 384-399.

Walther, J. B. (1996), "Computer Mediated Communication: Impersonal, Interpersonal and Hyperpersonal Interaction." Communication Monographs. Vol. 23, No.1, pp. 3-43.

Weisband, S. (2002), "Maintaining Awareness in Distributed Team Collaboration: Implications for Leadership and Performance" in Distributed work. P. Hinds and S. Kiesler (eds). Cambridge: MA, MIT Press, pp. 311-333.

Willmore, J. (2003), Managing Virtual Teams. NH: Rollinsford, Spiro Press.

Yin, R. K. (1994), Case Study Research : Design and Methods. Thousand Oaks, Sage Publications.

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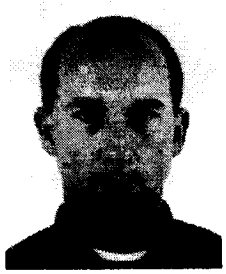

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Appendix - Questions that are same for Survey 1 and Survey 2

Tools that support team work: The following is a list of "tools" that can be used to work with other people. Please estimate the total time in minutes that you spent using each of the following tools communicating with at least one other member of your team.

	1=Strongly Agree			4=Neutral			7=Strongly Disagree
Q1. Virtual teamwork usually takes much more effort for effective communication and coordination than face-to-face teamwork does.	1	2	3	4	5	6	7
Q2. Without thinking very hard about it, I could list a number of good and bad practices for virtual teamwork.	1	2	3	4	5	6	7
Q3. I know the benefits and challenges of virtual teamwork	1	2	3	4	5	6	7
Q4. I think that training in virtual teamwork is necessary for a person who has no virtual teamwork experience but will	1	2	3	4	5	6	7
Q5. Virtual teamwork training/education is an important component of an MIS curriculum.	1	2	3	4	5	6	7
Q6. I can use computer-mediated communication technologies (e.g., email, WebCT, GSII, IM, video conferencing, Yahoo Groups, etc.) appropriately and effectively.	1	2	3	4	5	6	7
Q7. I do not like classes that require virtual teamwork.	1	2	3	4	5	6	7
Q8. I have a good basic understanding of virtual teamwork.	1	2	3	4	5	6	7
Additional questions in Survey 2							
Q10. My team was a heavy user of computer-mediated communication (e.g., Email, WebCT, GSII, IM, Yahoo Groups, etc.) for collaboration.	1	2	3	4	5	6	7
Q11. My understanding of virtual teamwork has increased as a result of taking this class.	1	2	3	4	5	6	7
Q12. My ability to work in a virtual environment has been enhanced as a result of taking this class.	1	2	3	4	5	6	7
Q13. This class was useful in terms of preparing me to work in virtual teams at some future time.	1	2	3	4	5	6	7
Q14. This class was useful in terms of preparing me to work in virtual teams at some future time.	1	2	3	4	5	6	7
Q15. I intended to make this project a success	1	2	3	4	5	6	7
Q16. I was motivated to do well on this project and worked very hard to make the project a success	1	2	3	4	5	6	7
Q17. At the beginning of the term, the instructor introduced basic concepts of teamwork, virtual teamwork, and computer-mediated communications. That information was very helpful	1	2	3	4	5	6	7
Q18. I am satisfied with my team's deliverable(s).	1	2	3	4	5	6	7

Tool	Total Minutes Used doing this project
Email	
Phone Calls	
WebCT	
Instant Messaging	
Face-to-face	
Other (specify)	

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