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EXAMINING FACTORS THAT AFFECT KNOWLEDGE
SHARING AND STUDENTS' ATTITUDE TOWARD THEIR LEARNING
EXPERIENCE WITHIN VIRTUAL TEAMS

by
JINXIA HE

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
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ABSTRACT

This study examined factors that might impact student knowledge sharing within virtual teams through online discussion boards. These factors included: trust, mutual influence, conflict, leadership, and cohesion. A path model was developed to determine whether relationships exist among knowledge sharing from asynchronous group discussion and the above five factors. In addition, this study examined if there are any relationships between quality and quantity of knowledge sharing and students' grades. A correlation design was conducted to discover if there are any relationships among these five factors and knowledge sharing within virtual teams. Participants in this study were 148 undergraduate students from two classes in the Health Services Administration program in the College of Health and Public Affairs. The two classes were asynchronous online courses and both instructors used virtual teaming in their online courses. Online interaction occurred via online discussion boards, email, and online chat rooms.

The results indicate that mutual influence and team cohesion are two major factors that directly affect knowledge sharing within virtual teams. Conflict mediates the relationship between trust and knowledge sharing. Leadership was also found to have a strong relationship with team cohesion, which then had a relationship with knowledge sharing. As far as the relationship between quality and quantity of knowledge sharing and the student's grade, it was found that there is relationship between the quantity of knowledge sharing and students' grades, however, no significant relationship exists between quality of knowledge sharing and students' grades. The implications of this research for use of virtual teams in online distance education are also discussed.

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CHAPTER ONE

INTRODUCTION

Introduction

Online education is prevalent in higher education. The use of computer-mediated communication (CMC) as a medium to support and enable collaborative learning is becoming a popular topic in research on online education. Research indicated that student learning can be enriched through team interaction by using educational technology and collaborative learning (Alavi, Yoo, & Vogel, 1997; Williams & Duray, 2006). Stunkel (1998) also noted there is a trend to use teams and groups within online learning environments in higher education. Furthermore, research has demonstrated that students can learn effectively when they work in teams where they can perceive different ideas and collaborate to achieve solutions for team projects (Johnson & Johnson, 1999).

In virtual teams, a group of people work at different geographic sites on a shared purpose using technology (Lipnack & Stamps, 2000). In order to work or learn together, team members need to share knowledge on what they are working on, how they are working, and with whom they need to work. Furthermore, in virtual teams, participants communicate via computer-mediated technology, but especially with text-based communication, non-verbal information cannot be transmitted. Due to the ambiguous and isolated nature of working virtually, it is easy for participants to become frustrated.

Some studies have investigated the factors contributing to successful team performance (Mathieu, Goodwin, Heffner, & Cannon-Bowers, 2000; Cooke, Salas, Kiekel, & Stout, 2003; Johnson, Lee, O'Connor, Khalil, & Huang, 2007). Knowledge sharing has been highlighted as

one of the main factors positively affecting team performance (Cannon & Edmondson, 2001). The purpose of this study is to examine factors facilitating knowledge sharing within virtual teams in an online learning environment. In doing so, this study draws from students' online postings regarding the assignments and projects on the discussion board on WebCT and reveals the factors that contribute to engagement in the knowledge sharing practice.

Knowledge sharing refers to sharing mutual knowledge, beliefs and assumptions (Clark & Brennan, 1991). Knowledge sharing can facilitate working and interacting effectively and efficiently. According to Mulder (1999), group members need a shared understanding of content, process, and each other. In virtual teams, participants must develop mechanisms for knowledge sharing which include the distribution of existing knowledge among team members and construction of new knowledge through critical thinking, reflection, and arguing from different perspectives. Knowledge sharing requires that team members exchange ideas among team members, participate in group discussions, provide feedback to inquiries, and are involved in group decision making. Prior researchers have studied knowledge sharing in business or corporation environments, but very few focused on virtual teams in an online learning environment (Nelson & Coopriker, 1996; Hendriks, 1999; Wasko & Faraj, 2005). This preliminary study will focus on exploring the factors from the social interaction perspective that affect knowledge sharing and how these factors affect knowledge sharing in virtual teams.

Problem Statement

Knowledge sharing is a crucial process in team work because participants need to distribute existing knowledge and construct knowledge through explaining, clarifying, critical thinking, and reflecting from different perspectives. Research studies conducted to examine the

use of discussion boards for online collaboration found that there is a correlation between student participation in online discussion and achievement (Krentler & Flurry, 2005; Gunter, 2007). To achieve learning outcomes, using online technology to reach and maintain knowledge sharing is more challenging with little or no face-to-face interaction. Based on Rosen (2007), the key elements in knowledge sharing are not only the technology provided, such as hardware and software, but also the interaction among team members; more specifically, the extent to which team members are willing to participate in the knowledge sharing process. For many online courses, group discussions are conducted to encourage students to challenge, reform, and synthesize their current views of knowledge through in-depth interaction with others (Garrison, Anderson, & Archer, 2001); however, findings from numerous studies have indicated that student engagement in group discussion is often quite shallow, and is rarely developed into a higher level of communication where negotiation, co-construction, and agreement occur (Tallent-Runnels, Tomoas, Lan, Cooper, Ahern, Shaw, & Liu, 2006). The problem is what factors affect team members' willingness to actively engage in the knowledge sharing process are not fully understood. While several factors have surfaced from the literature as having an influence on knowledge sharing behavior, empirical evidence for the existence and influence of these factors is fragmented.

Purpose of the Study

The purpose of this study was to examine and analyze the nature of the relationship among knowledge sharing and the five identified factors: trust, mutual influence, conflict, cohesion and leadership. In doing so, the study first explored the five factors affecting student's willingness to engage in knowledge sharing in virtual teams in an online learning environment.

Then the study used the path analysis to examine the direct and indirect effects among and between each of the above factors.

Within virtual teams, knowledge sharing mechanisms include interaction via email, phone, chat rooms, online discussion boards, and instant messages. Currently, both asynchronous and synchronous online discussions have been widely used in online learning. Asynchronous online discussion is used more often than synchronous online discussion since the latter requires real-time online participation (Wu & Hiltz, 2004). Since the courses in this study are fully online, students are not required to have face-to-face meetings during classes. Most teams rely on asynchronous group discussion on WebCT discussion boards as their primary venue for interacting at a distance. Moreover, according to Vygotsky (1967), social interaction plays a significant role in cognitive development. Social interaction enables students' active learning through participating group discussion, problem solving and knowledge sharing. Students may feel isolated when there is no or less social interaction. Group discussion conveys student's thinking through inquiring, explaining, clarifying, and defending the ideas. During these processes, the learners engage in cognitive learning through clarifying ideas and generating new knowledge. (Brown & Palinscar, 1989; Jonassen, Davison, Collins, Campbell, & Bannan Haag, 1995; Norman, 1993; Gunter, 2007). Researchers also indicated using written form to communication with peers online is more powerful; the writing process does not require immediate feedback, so students have enough time for elaboration in order to convey meaning more clearly and comprehensively (Koschmann, Kelson, Feltovich, & Barrows, 1996). In a face-to-face team, however, Macdonald (2003) claimed that members may interact through facial expressions, such as, smiling, gestures and body language; which can not be translated to virtual teams.

In a virtual team, members mostly use text based messages to communicate, which makes the process of collaboration more transparent because the students' postings on discussion boards can be used to judge both their teamwork and individual contribution of the process. In addition, the product of the teamwork can reflect the team collaboration through mediums such as an essay, a report, or a website. The students may provide their ideas from different perspectives and work together on the team work; they may provide individual critiques of an online debate. This teamwork can be a collaborative process for developing collaborative products. Previous studies did not combine the quantitative and quality aspects of participation. Here quantitative participation refers to participation rates and qualitative aspects deal with nature of discourse (Lipponen, Rahikainen, Lallimo, & Hakkarainen, 2003). In addition, previous studies on knowledge sharing within virtual teams have mainly focused on the business or corporate environment. In this study, we focus on the students sharing knowledge on the WebCT discussion board. In doing so, the researcher examined the knowledge sharing process by looking at the quality and quantity of students' online posting on their own group discussion board on WebCT.

In this study, quality of knowledge sharing was measured by a scale developed by DeLone and McLean (2003). These items measured six attributes of the content of the shared knowledge: relevance, ease of understanding, accurateness, comprehensiveness, consistency, and timeliness; the researcher used the number of students' online postings as an indicator of quantity of knowledge sharing. In addition, the researcher already realized that there were some off-topic or social exchange postings during the beginning of the team formation, such as the students exchanging contact information, or giving personal introductions. So when the researcher

counted the number of knowledge sharing activities, she excluded those off-topic postings, and only included those postings related to subject matter as quantity of knowledge sharing.

Research Questions

The following research questions guided this study:

1. Are the five factors affecting knowledge sharing within virtual teams in the online learning environment as represented in the path model consistent with the data collected?
2. To what degree does the *quality* of knowledge sharing have an impact on students' grades within virtual teams?
3. To what degree does the *quantity* of knowledge sharing have an impact on students' grades within virtual teams?

Theoretical Foundation and Empirical Foundation

Social Interdependence Theory

The founders of Interdependence Theory, Kurt Koffka and Kurt Lewin (1948) summarized interdependence as the nature of the group dynamics which can result in (a) any members' behaviors influencing other's performance; and (b) the common goals of the group motivating members to work together. The basic premise of Social Interdependence Theory states that there must be a type of interaction where individuals will have each other determine the outcomes (Johnson & Johnson, 1999). Positive interdependence, which Johnson and Johnson (1999) addressed, refers to interactions in which positive relationships were developed through team processes. In a collaborative learning environment, students support and encourage each

other and work together to achieve a common goal. Both the level of influence that students have on each other and the abilities of better students helping the poorer students lead to successful teamwork.

Cognitive Development Theory

Based on Piaget's theory, the social-cognitive conflict is raised from the various perspectives; ideas in a cooperative environment may create cognitive disagreement, which then stimulates cognitive development (Piaget, 1965). The learning experience is enhanced because multiple perspectives are considered. Furthermore, Vygotsky (1978) believed that the process of the students' interaction and cooperative learning, understanding and problem solving lead to the construction of knowledge.

When team members work together in an online learning environment, they may have different opinions, interpretations, and solutions for problem solving, which then arise conflict. Conflict is a main component which cannot be avoided in student teams (Kahn, 2008). Conflict can arise in many circumstances, such as how and when teams would like to meet, what kind of technology is needed for communication (video conference, emails or discussion boards), or how to format presentation slides. Conflict also may arise from differing attitudes or problem solving approaches, such as, whether or not to meet face-to-face in virtual teams or whose ideas or solutions to adopt for the project. If these disagreements cannot result in compromise or uniformity, conflict may arise. However, these divergences can lead to further elaboration through the negotiation of the different opinions (Bossche, Seger, & Kirschner, 2006).

Social Constructivist Theory

Social Constructivist Theory addresses the need for collaboration among learners. Learners developed their skills through problem-solving in collaboration with more capable peers. Knowledge sharing and knowledge construction can be enabled by active participation, interaction and dialogue through collaborative learning (Jonassen et al., 1995). The theory suggests that learning is more effective when students are involved in discussions with their peers about, their ideas, experiences, and perceptions. As Jonassen and his colleagues explain, the process requires active participation and interaction with others (Jonassen et al., 1995). In this study, we are exploring the relationship between the team's interactive dynamics and the results of their knowledge sharing experiences using discussion boards on WebCT within virtual learning teams.

Significance of the Study

Knowledge sharing happens when students participate in online discussions, respond to inquiries, and provide comments and feedback on previous postings. Knowledge sharing is a crucial process in virtual teams. Successful knowledge sharing in virtual teams requires examining the associated factors. Social interaction between team members has been examined as the key point that affects students' learning and performance in virtual teams. Putting students into groups does not guarantee increased levels of collaboration. This study will try to explore the factors which influence knowledge sharing in virtual teams, as well as examine if the degree of knowledge sharing will affect students' grades within virtual teams. The results from the study can provide educators, as well as students, some insights into understanding the process of knowledge sharing in virtual teams. Furthermore, the study will provide guidelines for

instructional designers and educators who wish to create sound social environments to facilitate knowledge sharing within virtual teams in online learning environments.

Overview of Dissertation

Using a quantitative path analysis, this study was designed to examine the direct and indirect effects among knowledge sharing and the following factors: trust, mutual influence, conflict, leadership, and cohesion. In addition, the study sought to see if there was any relationship between quality and quantity of knowledge sharing and students' grades. Quantity of knowledge sharing is based on the number of postings that an individual posted on the online discussion board on WebCT.

The dissertation chapters are organized as follows. Chapter Two provides a review of literature on virtual teams, knowledge sharing, and factors affecting knowledge sharing. In addition, the chapter presents the conceptual framework derived from the literature review and the research hypotheses. Chapter Three presents the research methodology used in this study. This includes the research design, operational definitions, instruments development, and research procedures. Chapter Four describes the results of the study from the statistical analyses. Chapter Five explains the results of the study. The dissertation will conclude with a discussion of the implications for research and practice, limitations, and the conclusion.

Table 1: Operational Definitions

Constructs	Origination	Operational Definition
Virtual Team	Lipnack & Stamps (2000)	People work independently with a shared purpose across space, time and organizational boundaries using technology.
Knowledge Sharing	Gibbert & Krause (2002)	Knowledge sharing refers to the willingness of individuals in a group to share with others the knowledge they have acquired or created.
Mutual Trust	Anderson & Narus (1990)	The degree to which a virtual team member believes his/her partners work well with each other.
Mutual influence	Anderson & Narus (1990)	The degree to which the ability of virtual team members affects the executing tasks of each other.
Team Cohesion	Mullen & Copper (1994)	The nature and quality of the emotional bonds of friendship such as liking, caring, and closeness among team members.
Conflict	Jehn et al. (1999)	Disagreement or divergence that occurs when team members possess different ideas, opinions, goals, or information about the task.
Team Leader Skills	Parker (1998)	Team leaders who demonstrate the ability to work well with others in a team setting are likely to succeed. Working well with others includes such process behaviors as being open to new ideas, being supportive and encouraging of members, recognizing and praising members for their contributions, and empowering team members to act.

CHAPTER TWO REVIEW OF LITERATURE

Introduction

The theoretical foundations of this research lie within three streams of literature: virtual teams, knowledge sharing, and online collaborative learning. Relevant literature was reviewed in a separate section as below. It has already been noted that the research studies on knowledge sharing within virtual teams existed both in business and academic areas. For this current study, the researcher focused on the how undergraduate students share knowledge within virtual teams in an online learning environment.

Many studies have demonstrated the benefit of collaboration (Azmitia, 1988; Ellis, Klahr, & Siegler, 1993; Bonk, Wisner, & Lee, 2004). Collaborative learning refers to learners at different capability levels working together on a common purpose. Research indicated that team members exchanging ideas not only increases a learner's motivation to learn, but also improves critical thinking skills. Certain conditions enable students to collaborate with others. Learners work together when they can get support from others and when they find ways to develop trust and communicate openly. Even if the task is complex, students seem to learn better or solve more problems correctly when they are willing to collaborate with others. (Gabbert, Johnson & Johnson, 1986). In addition, collaboration has other beneficial effects, such as improving social relations, and increasing students' motivation (Sharan, 1980; Gunter, 2007). Thus, more and more educators employ collaborative work in their classes. To learn from each other and therefore perform better on the project, teamwork is increasingly implemented in schools and organizations (Bossche, Segers, & Kirschner, 2006). Teams or groups are expected to work

together to solve problems; however, research and practice show that the expected benefit of teamwork is not always reached (Barron, 2003). The online teams face the challenge of integrating different perspectives and developing a shared understanding of the problem. In addition, in their research agenda for online collaborative learning, Reeves, Herrington, and Oliver (2004), posited that the reality of online collaborative learning is disappointing in higher education. Therefore, they claimed that an urgent need existed for development research to provide design guidelines for collaborative online teaching and learning.

Reeves, Herrington, and Oliver (2004) illustrated that the two aspects of online collaborative learning were working online and collaboration. By working online, learners have the flexibility to access all learning resources at any time and any location with convenience. The learning processes and online interactions take place through asynchronous or synchronous procedures. Synchronous online interactions refer to communications that occur at the same time electronically using technologies such as chat-rooms or videoconferences; asynchronous online interactions take place at any time and places using email or online discussion boards. They give learners enough time to provide feedback and comments with collaboration; learners conduct most of their learning activities in groups, although they are often geographically isolated. The students' grades will mostly depend on the quality of the teamwork. In such circumstances, most learning will take place via online interaction.

This study investigates the factors affecting students' collaborative learning through engaging in building and maintaining mutual sharing cognition. It draws from looking at the students' online postings on the discussion board on WebCT and reveals the factors that contribute to engagement in the knowledge sharing practice. In doing so, this chapter starts by introducing the concept of virtual teams and student learning practices within virtual teams.

Next, it describes the concept of knowledge sharing and the characterizations of knowledge sharing. Subsequently, it examines the students learning processes and knowledge sharing within virtual teams. Finally, the chapter synthesizes the current and prior research literature on the factors affecting knowledge sharing in virtual learning teams. A conceptual framework will be developed and progressively refined through the prior literature review and the current empirical study.

Virtual Teams

In virtual teams, a group of people work at different geographic sites on a shared purpose using technology (Lipnack & Stamps, 2000). Based on this definition, there are three factors: first, it is a team; second, team members are physically separated; and third, the communication is electronic. Virtual teams are being used in both education and business in an attempt to enhance collaboration and cooperation. Dede (1996) suggested that students' knowledge, higher level concepts, and skills can be acquired through online collaborative learning which has been a weakness of traditional non-interactive distance education. Slavin (1990) recommended using collaborative learning to develop an online community. The essence of collaborative learning includes sharing learning tasks, and combining expertise to improve the quality of the learning. Virtual teams are vehicles to achieve collaborative learning in distance education. Many professors use virtual teams in their online classes.

It is expected that in teams, students working together with different backgrounds, experiences, and knowledge will be more effective than if working individually. However, challenges and problems on collaboratively constructing new knowledge were presented on virtual team collaborative learning based on the recent studies (Beers, Boshuizen, Kirschner, &

Gijselaers, 2006; Fischer & Mandl, 2005). First, there is little or no chance to meet face-to-face in virtual teams. In virtual team environments, assignments and projects can be worked on through self-direction and collaboration. Putting students into teams does not guarantee collaboration. Second, trust occurs when teammates are able to work together to complete a common task. In virtual teams, team members may not know each other before, and students may feel uncomfortable interacting with those students they did not know beforehand; trust is much harder to develop without physical human interaction. Kerr and Bruun (1983) identified the “free-rider” as another potential problem in virtual teams. “Free-rider” is also known as social loafing, which occurs when some members of a group do not do their part of the teamwork. In addition, the “sucker effect” arises when the team members exert less effort as their awareness of the peer members’ free-riding increases. The other problem is that students face the challenge of integrating different perspectives and developing a shared understanding to solve the problems (Bossche, Seger, & Kirschner, 2006). It not easy to get a consensus within a virtual environment since there are cultural differences, different styles of conflict management, and trust issues that may change the way people communicate. Therefore, they may have different perspectives on problem solving. This can be established through rich interaction, interactive discussion, and negotiation (Daft & Weick, 1984; Roschelle, 1992).

Despite a growing number of research studies investigating online collaboration and virtual teaming, there is little empirical research examining what factors affect knowledge sharing and if knowledge sharing affects student learning achievement within virtual teams in online courses. In virtual teams, people have little or no chance to meet face-to-face; team members may not know each other, and the participation in knowledge sharing is voluntary. Students may find useful information posted by others without contributing anything in return.

In prior research studies, many have focused on examining the impact of structural conditions on knowledge sharing within virtual teams. These conditions include group size, nature of the task, and technology usage (Webb & Palincsar, 1996; Yoo & Alavi, 2001). Although the effects of these structural factors exist, it is difficult to determine the immediate impact of these structural conditions on team work (Dillenbourg et al., 1996). Actually, Barron (2003) argued that this entails an articulation of how characteristics of interaction (discourse practices) interact with the knowledge sharing process.

Social Constructivist Theory

Social Constructivist Theory addresses the need for collaboration among learners. Learners develop their skills through problem-solving in collaboration with more capable peers. Knowledge sharing and knowledge construction can be enabled by active participation, interaction, and dialogue through collaborative learning (Jonassen et al., 1995). This theory suggests that learning is more effective when students are willing to share their perspectives with their peers. Learning and development are social and collaborative activities. In the online learning environment, discussion boards provide a means for dialogue, discussion, and debate which leads to social construction of knowledge. Learners vary in terms of their abilities and willingness to learn collaboratively within the online learning environment. Learners work together on a common purpose, especially in virtual teams. The extent to which those members work with, engage, and communicate with each other leads to effectiveness of teamwork.

From the Computer Supported Collaborative Learning (CSCL) perspective, students learn from actively participating in knowledge building. Harasim (1989) illustrated collaborative learning by saying:

knowledge building occurs as students explore issues, examine one another's arguments, agree, disagree, and question positions. Collaboration contributes to higher order learning through cognitive restructuring or conflict resolution, in which new ways of understanding the material emerge as a result of contact with new or different perspectives...collaborative learning is predicated upon interaction. (p.55)

Expectancy Value Theory

Motivations underlying individuals' behaviors have been explained by the Expectancy Value Theory. Borders, Earleywine, and Huey (2004) demonstrated the theory as "individuals choose behaviors based on the outcomes they expect and the values they describe to those expected outcomes." The level of one's willingness to perform a particular behavior is dependent on (a) the belief of what consequence will occur, and (b) how the individual considers the value of consequence (Mazis, Ahtola, & Kippel, 1975). Thus, the individual's outcome expectations affect his/her attitudes towards the behavior.

This study draws on Social Interdependence Theory, Social Cognitive Theory, Social Constructivist Theory, and Expectancy Value Theory to investigate the factors affecting knowledge sharing practices within virtual learning teams. The outcome will be seen by examining the two characteristics of knowledge sharing: the quality of knowledge sharing and the quantity of knowledge sharing using WebCT discussion boards. If students feel that sharing knowledge

with team members can generate more new ideas, can expand interpersonal relationships, or give them a sense of accomplishment, then they will be more willing to engage in the knowledge sharing practices.

Asynchronous Learning Network and Online Discussion Board

An Asynchronous Learning Network (ALN) is defined as an environment in which learners use computers and other communication technologies to work with their peers and instructors, but they do not need to be online at the same time (Mayadas, 1999). Students can access the online learning environment to interact with their peers and instructors, anytime, and anywhere. Except for the nature of flexibility and convenience, the most important feature of an ALN learning environment is to support collaborative learning through social construction. Due to social interactions and knowledge sharing among learners, learning results can be enhanced when compared with individual-oriented learning.

In online collaborative learning environments, students engage in text-based discussions with each other on discussion boards by creating diverse perceptions, ideas, and concepts were combined and constructed by learners through online discussion (Wu & Hiltz, 2003). The messages posted by students were listed by date of their posting, with the latest postings on top. Online discussion plays an important role in student learning in an online learning environment. In their study to investigate the relationship between the online discussions and student perceived learning, Wu and Hiltz (2004) found that online discussions improved students' perceived learning. The literature summarized the advantages of online discussion boards for student learning within virtual teams in online learning environments. Rains and Scott (2006) demonstrated that online discussion boards provide students effective methods to exchange

information since students do not need to be online at the same time; in addition, students have more time to think about their responses or contributions on online discussion boards. Another beneficial feature for online discussion boards is that they offer a record of the interaction occurring between the team members; therefore, students or instructors can keep track of the students' progress and be aware of who is responsible for certain tasks.

Larkin & Hein (2001) designed their studies to examine the effectiveness of online discussion groups for their students in understanding physics. In their results, they reported that: (a) online discussions provided a flexible environment in which students could share their ideas at different times and locations; (b) online discussions facilitated the critical thinking and encouraged knowledge construction; and (c) students became more proficient at transferring and applying what they learned in classes to real life situations.

Online Collaborative Learning and Knowledge Sharing

Computer-supported collaborative learning (CSCL) is the educational use of online groups (Brandon & Hollingshead, 1999). CSCL research primarily draws from two areas, collaborative learning theory and computer-mediated communication (CMC) theory and research. The definitions of CMC in learning may vary, but the major characteristic is that of human communications via computers and via many different forms of synchronous and asynchronous interaction. CMC includes email, online chat, instant messaging, online discussion boards, online forums, and videoconferencing. The major focus for this study is asynchronous interaction, the form of interaction that is used most commonly in current online courses.

According to the Social Constructivist Theory, learning environments should provide opportunities for students to articulate, clarify, and reflect on course content. During this process, students work together, engage, and communicate with each other to construct new concepts or knowledge. In this manner, dialogue and online discussion provides opportunities for cognitive processes, such as knowledge sharing and knowledge construction to occur (Jonassen et al., 1995). This theory suggests that learning is more effective when students interact with their peers; they are able to share their ideas and experiences. Jonassen and his colleagues emphasized that the key components of this process are active participation and interaction among peers (Jonassen et al., 1995). From a CSCL perspective, students learn from actively participating in knowledge building. Harasim (1989) illustrated collaborative learning with the following:

knowledge building occurs as students explore issues, examine one another's arguments, agree, disagree, and question positions. Collaboration contributes to higher order learning through cognitive restructuring or conflict resolution, in which new ways of understanding the material emerge as a result of contact with new or different perspectives...collaborative learning is predicated upon interaction. (p.55)

Kreijns, Kirschner and Jochemes (2003) have asserted that social interaction is the essential part to collaboration and collaborative learning and they illustrated the social interaction from two dimensions, cognitive processes and social emotional processes. Furthermore, Kreijns and colleagues investigated two issues regarding social interaction in an online learning environment. The first issue is taking for granted that social interaction will happen if the communication medias are provided for students. The second issue is that students do not have a sense of belonging to a learning community; therefore, they are unwilling to be involved in learning. In other words, if team members initially do not know each other and the team has

never worked together before, then team forming, team processing and team development, are essential to developing a learning community.

Traditionally, collaborative learning theory has primarily dealt with classroom-based groups, or face-to-face groups, not virtual teams. Therefore, the question is raised as to whether or not the benefits of the collaborative learning can transfer to an online environment. In addition, we already noticed the lack of non-verbal communication in CMC. Most students in online teams are still using online discussion boards to communicate with their peers. Therefore, they can see the online postings on the monitor but not the live image of the person. Several researchers supported that collaborative learning and CMC can work together and be mutually beneficial (Brandon & Hollingshead, 1999). The benefits of online collaborative learning and student-centered learning in higher education have been widely recognized in literature. Weigel (2002) proposed an innovative model for online collaboration; he recommended the construction of virtual, collaborative spaces, called “knowledge rooms” where learners can engage in “deep learning”, students sharing knowledge and developing their own knowledge through communities of inquiry. In an ideal online collaborative learning environment, team members are supposed to discuss and solve problems in an active and reflective way; however, learning in open discussion rarely results in equal participation and individual contribution to the team (Fischer & Mandl, 2001).

In order to acquire some understanding of how online collaboration takes place, MacDonald (2003) maintained that there are two factors affecting students’ online collaboration: the online learning environment and student online interaction. For the online learning environment, she mentioned that knowledge exchange tools and the software environment can speed up effective participation in an online learning environment. From the student online

interaction perspective, students need to learn how to interact online with their peers and to understand the extent to which their interaction contributes to their learning and understanding varies with their competency. Mayrhofer (2005) summarized that the key components of virtual learning collaboration include: (a) a common purpose or goal, (b) interdependence, and (c) sharing information and resources. Salmon (2000) claimed the stages involved in online collaborative learning include motivation, socialization, knowledge exchange, knowledge construction, and development. Student online interaction also can be illustrated by these stages. Finally, if students need to work collaboratively on a common task, they also need additional skills, such as negotiation skills, group decision making skills, and task management skills (Schrage, 1990). Again, MacDonald (2003) emphasized that the affective factors here, such as group cohesion and the development of mutual trust are significant.

Previously, we mentioned that knowledge exchange and knowledge construction are some of the most important stages in online collaborative learning. In this study, we will label knowledge exchange and knowledge construction as knowledge sharing. More specifically, knowledge sharing refers to individuals willing to share their acquired knowledge with their peers (Gilbert & Krause, 2002). It is the process by which individuals make their knowledge available to others. Davenport (1997) defined knowledge sharing as a voluntary action. Wasko and Faraj (2005) indicated that knowledge sharing in an online environment primarily occurs when individuals are motivated to engage in the discussion, review the previous postings, and provide feedback based on their understanding and experiences. This process of formulating the response takes time and effort. This process starts with one of the team members posting a problem situation and his or her opinions on how to deal with it. The fellow team members actively understand and reflect on postings and try to grasp the given explanation by using this

understanding to give meaning to the situation at hand (Webb & Palincsar, 1996). This process can evolve from existing knowledge exchange to new knowledge construction by refining, building on, or modifying the original offer in some way (Baker, 1995; Soller, 2004). Knowledge sharing included activities such as team members reading the previous postings, responding to inquiries, and clarifying and elaborating meanings. This process requires students to participate and interact with each other to brainstorm, integrate, and distribute information. This exchange of ideas and negotiation of meaning facilitates knowledge sharing and knowledge construction (Rosen, Furst, & Blackburn, 2007). Brown and Duguid (2001) suggested that the outcome of knowledge sharing can be examined by the quality of students' projects and their participation in the team discussions.

Wenger (1998) asserts that knowledge construction occurs in communities when learners are involved in problem solving and the sharing of ideas through articulating, clarifying, and negotiating on the ways to solve the problems. For a truly vibrant community, members should participate in knowledge exchange, engage in live chats, participate in asking questions and answering prior messages, and provide feedback to their peers (Hayes & Walsham, 2000). How the social context influences sociocognitive processes in collaborative groups remains largely uninvestigated in educational psychology (Bossche, Segers & Kirschner, 2006). However, the reasons why learners are willing to actively participate in knowledge sharing within virtual teams are not well understood (McLure & Faraj, 2000). Although knowledge sharing can be assessed by using a variety of methods, we will focus on two aspects for this study: the quantity of knowledge sharing through counting the amount of the individual's postings and the quality of the knowledge sharing through an online survey.

The Factors Affecting Knowledge Sharing within Virtual Teams

Numerous factors were identified that affect individuals sharing their knowledge with their peers online, ranging from self-esteem boosting to altruistic behaviors (McLure and Faraj, 2000; Chiu, Hsu, & Wang, 2006; Wu, Lin, & Lin, 2006). Osterloh and Frey (2000) compared the effects of intrinsic and extrinsic motivation on knowledge sharing. Their results indicated that intrinsic motives influence sharing more powerfully than extrinsic factors (McLure and Faraj, 2000; Chiu, Hsu, & Wang 2006; Wu, Lin, & Lin, 2006). Rosen, Furst, and Blackburn (2007) asserted that increasing team cohesion, members' satisfaction, and motivation can improve the proficiency of knowledge sharing within virtual team members. Social context here was identified as the key to nourish conflicts and maintain a sound learning environment to facilitate mutually shared cognition. (Barron, 2003; Crook, 1998).

Trust

The definition of trust was adapted from Anderson and Narus (1990) as the degree to which that a team member believes his/her partners work well with each other. Trust has been recognized as “at the heart of knowledge exchange” (Davenport & Prusak, 1998, p.35). Researchers have found that high levels of trust are the key to effective communication (Dodgson, 1993). In addition, trust is examined to “improve the quality of dialogue and discussion and facilitate the sharing of knowledge” (Ichijo, Roos & Kleine, 2000, p.200). Mutual trust is defined as the expectations shared by the team members that they will meet their commitments to each other (Dasgupta, 1988). The increased level of trust leads to a higher level of knowledge sharing. In return, the constant communication exchange can build trust which

enhances student willingness to be involved in knowledge sharing (Anderson & Narus, 1990; Ardichvili, 2003).

Kahn (2008) demonstrated that in those successful virtual teams, trust was developed among team members. Members of those teams felt safe to speak honestly to their peers. They believed in other members and they thought their members would work hard. On the contrary, in those teams that failed to build trust, they did not believe in each other's intentions. They doubted each other's competence and they did not trust each other. Kahn further illustrated these commitments, and found that seeking and providing useful feedback are essential to build trust among peers in teams. Because most students do not know each other before, they are normally uncertain about how much they can trust each other when they first work in virtual teams. However, based on some behaviors and students' attitudes, team members might have some judgment on their members. For instance, how much do the team members care about their project? Will the students do whatever they promised to do? Will the students provide feedback and make any contributions? If the answers for all of these questions are positive, students may begin to trust their team members.

Lee and Choi (2003) reported that trust can help to manage conflict. If conflict was constructively dealt with, then exploring the disagreement and divergences which raised the conflict could stimulate knowledge creation and promote the development of new ideas. Further, Tjosvold (1997) contends that when conflict is well managed, it enables team members to learn from differences. In truly successful virtual teams, the members can express their ideas, beliefs, and perspectives openly; they compare the differences and figure out the most appropriate one to fit the project. In this manner, conflict can strengthen the inter-dependence and allow for more innovative and productive work. Therefore, when there is trust developed among team members,

conflict is well-managed, which can facilitate knowledge sharing and increase the potential opportunities for knowledge creation through subsequent interaction.

Kanawattanachai and Yoo (2003), in their empirical study, examined the relationship between trust and team performance within virtual teams through early, middle and late stages of the project time. They collected data from 36 student teams at six universities over eight weeks. The results indicated those students had similar levels of trust between high and low performance virtual teams. However, high-performance teams developed and maintained higher levels of trust throughout the project.

Rosen, Furst, and Blackburn (2007) advocated that the trust among team members plays a significant role in the quantity and quality of knowledge sharing within virtual teams. They further demonstrated that the members in the teams that have a higher level of trust can see commitments from each other, trust each other, and feel delighted as members of the teams. In their qualitative research on examining the barriers to knowledge sharing in virtual teams, Rosen, Furst, and Blackburn (2007) found that at the beginning of the virtual team forming, there is very limited knowledge sharing among team members. The knowledge sharing procedure at this period may be very basic and lack details. Team members at this time have not developed trust yet; they are not secure enough to say what they think and feel.

Wasko and Faraj (2005) reported in the results of their empirical testing on their knowledge sharing model that people are willing to share knowledge with their peers when they have sharing experience and when they perceive that making contributions can enhance their reputation among team members. In addition, they demonstrated that people engage in knowledge sharing when individuals perceive cohesiveness in their teams, a social tie among team members. Prior research states that the way to measure the cohesiveness among team

members is to determine the number of social ties that the individuals have (Ahuja et al, 2003). A social tie can be created when one answers others' postings in an online environment. Trust has been identified as a key element in fostering the level of participation or knowledge sharing in virtual teams.

Mutual Influence

Mutual influence is another factor that affects knowledge sharing in online teamwork. From Vygotsky's (1978) perspective on Cognitive Development Theory, the interaction of peers on performing tasks facilitates the learning of concepts. Vygotsky defines a 'zone of proximal development' as "the distance between the actual developmental level and the level of potential development which can be reached through problem solving under the help of an experienced person or a more capable peer (p.86)". The level of learning that occurs is largely dependent on the process of the students' discussion, problem solving, arguing, elaborating their viewpoints and listening to others' viewpoints (Jucks, Paechter, & Tatar, 2003). The process of providing mutual feedback, engaging in discussion, and listening to others' viewpoints can not only facilitate the students' learning of content but can also fosters the learners' intrinsic motivations (Damon, 1984). Whipp and Chiarelli (2004) found that students "used the continuous feedback of their peers to make judgments of their work" (p.15). Additionally, students reported that teachers' and their peers' constant presence on the discussion board added incentive for them to continue participation in the teamwork. One student stated: "I depended on the interaction with other students to keep myself motivated, and when that wasn't there, my motivation dropped a lot." (Whipp & Chiarelli, 2004).

Lipponen, Rahikainen, Lallimo, and Hakkarainen (2003) investigated the participation and discourse in computer-supported collaborative learning, and they discovered that in a collaborative learning environment, learners are more likely to mutually influence each other. In this constructivist learning environment, learners play a more active role to engage in various class activities, such as to participate in online discussion, clarify ideas, ask questions, and answer questions from their peers and instructors. The information distributed among team members can provide participants possibilities to pursue pedagogically valuable discourses. Therefore, this process may facilitate students working collaboratively for knowledge sharing and development, as well as to facilitate students' critical thinking to achieve a higher level of learning.

Team Conflict

Team conflict is identified as the factor that affects the knowledge sharing in virtual teams. Conflict was defined by Jehn, Northcraft, and Neale (1999) as “disagreement and divergence that occurs when team members possess different ideas, opinions, goals, or information about the task.” Yet, there appears to be inconsistencies in the literature review regarding the role of conflict on knowledge sharing. When team members work together, they may have different opinions, interpretations and solutions for problem solving. This divergence can lead to a further elaboration of disagreement through the negotiation of the different meanings (Bossche, Seger, & Kirschner, 2006). In their study, Hollenbeck, Colquit, Ilgen, LePine, and Hedlund (1998) found that team members whose recommendations were uncorrelated or negatively correlated (i.e. conflict) provided more valuable information than

team members whose recommendations were highly correlated since some of them were redundant.

Kahn (2008) demonstrated that most people consider conflict as a bad thing and something best avoided; however, Kahn suggests that conflict can help manage differences. Kahn illustrated that conflict is a main component in student teams. Conflict can arise in many circumstances, such as how and when would team members like to meet, what kind of technology is needed, (video conference, emails or discussion boards), or how to format and style slides. The conflict may arise from the different attitudes or problem solving approaches, such as, whether or not meet face-to-face in virtual teams, the extent to which learners can control the decision on the project. Without conflict, team members will agree too easily and the best ideas or solutions will remain undiscovered. The critical issue here is how team members can face the conflict. However, De Dreu and Weingart (2003) argued that the emergence of differences in opinion does not guarantee conceptual advancement because it may be taken as a paradox and resolved by ignoring one of the elements.

Jehn (1994, 1995) proposed that task conflict can be beneficial to team performance when working on complex tasks which do not have standard solutions. In contrast, another argument is that team conflict may not be considered as the difference in interpretation of the problems but as a personal, emotional rejection which can interfere with team behavior (De Dreu & Weingart, 2003). In addition, Lovelace, Shapiro, and Weingart (2001) found a negative correlation between task conflict and team performance.

Panteli and Sockalingam (2005) described conflict as a “double-edged sword.” They claimed that in a complex environment, if the disagreement and divergence with teamwork are poorly understood and managed, then trust can be undermined; therefore, the relationships

among team members will be damaged and the knowledge sharing among team members will be broken down. However, when all are well managed, conflict can strengthen relationships and trust, and facilitate knowledge sharing.

Putting students into groups does not guarantee collaboration (Johnson & Johnson, 1999). Wu et al. (2006) conducted a study to explore factors affecting knowledge sharing in virtual teams; some behaviors such as social loafing and free-riding (Kreijin, Kirschnner, & Jochems, 2003) were found to lead to team conflict. Social loafing refers to the phenomenon where, some member in a group does not contribute his or her share of teamwork and the others have to carry the load. Narus (1990) also found that disagreement between team members causes conflict in the process of knowledge sharing within virtual teams.

Team Cohesion

Team cohesion was defined by Mullen and Copper (1994) as the nature and quality of the emotional bonds of friendship such as liking, caring, and closeness among team members. Carron (1982) described cohesion as “a dynamic process which is reflected in the tendency for groups to stick together and remain in the pursuit of their goals and objectives.” (p.124). Carron noted that cohesion was recognized as a multidimensional concept. Different types of cohesion were distinguished, and the most popular two categorizations were the task cohesion and social cohesion. Task cohesion refers to a shared commitment among team members to achieve the goals or objectives for the team. Social cohesion refers to the nature of the emotional bonds between team members (Copper, 1994). In their study to identify the social and cognitive factors affecting collaborative teamwork, Bossche, Segers, and Kirschner (2006), found that task cohesion had a direct relation to the rise of mutually shared cognition. Tziner (1982) described

that task cohesion occurs when individuals work together to achieve desired outcomes that cannot be obtained through individual achievement. Zaccaro, Rittman, and Marks (2001) illustrated that in task cohesive groups, team members' goal attainment is bound together to collective achievement, so they care about each other's performance.

Studies have reported that it is more likely to find favorable communication interactions among cohesive team members, who exhibit more positive, personal and favorable communication interactions (Hogg 1992). Students who are cohesive tend to be more willing to engage in the teamwork, they are more motivated to provide thoughtful input and are willing to spend more time contributing to group discussions, instead of focusing efforts on the proportion of their work. Members with higher levels of cohesiveness would continue working on their project rather than give up when they face problems or difficulties. Zaccaro, Gualtieri, and Minionis (1995) provided evidence demonstrating that team members will persist at the task when they faced with the problems or failure. In addition, teams with higher levels of task cohesion outperformed their counterparts in lower cohesion teams under problematic situations.

Based on McGrath and Hollingshead (1994), computer-mediated environments often lead to lower levels of cohesion and members tend to be less motivated than the students working in face-to-face groups. Computer-mediation decreases the opportunities for social integration, since in such environments, learners pay more attention to task related work, and pay less attention to social-emotional processes.

These studies imply that common characteristics within cohesive teams include: sociability, friendliness, and warm interactions among team members. One is more likely to find friendship (liking, caring, and closeness), within those teams that can enhance the students'

participation in teamwork communication. Therefore, the researcher argues that team cohesion will increase the task participation and knowledge sharing process among the members.

Leadership

Leadership also was highlighted as one of the factors affecting knowledge sharing in virtual teams. Several studies contended that leadership appears to be a determinant of team success (Misiolek & Heckman, 2005). For example, Johnson, Surya, Yoon, Berrett, and Fleur (2003) conducted a quantitative and qualitative study to examine how virtual learning teams develop their group process. They discovered that not all of their virtual teams had a team leader. In fact, only two of the seven teams had a leader emerge. The instructors did not assign a team leader. The definition for team leader is vague in virtual team literature. In their study exploring collaborative online learning, Curtis and Lawson (2001) observed that there are two forms of leader within online teams: the kind of student who made many contributions that were classified as organizing team work and initiating activities or the one who made a greater proportion of contributions that were seen as giving help and feedback. Yamaguchi, Bos and Olson (2002) also summarized two types of leaderships; briefly, task-focused leadership refers to focusing on the task at hand, and relationship-related leadership refers to improving team cohesion. According to Ali, Pascoe, and Warne (2002), in teams characterized by cohesiveness, the leaders took on a facilitator role rather than a commander role, thus allowing members to pick up each part of the project based on their individual strengths. The leader may create certain space for each member to lead at a certain part in the project.

Sometimes the team leader was identified as the same person as the assignment compiler. The team compiler would take the responsibility to initiate the discussion, set a timeline for the

project, and submit the assignment for the team. Some teams shared the leadership role which means the team members rotated as team leader on different projects or assignments.

Zigurs (2003) suggested that in real life virtual learning teams, the role of leadership may shift among team members. Each member may lead at certain points in the project based on their strengths. This shared leadership among team members provided a feeling of value and appreciation for each other.

There is no official team leader within virtual teams. The instructors did not make any member of the teams responsible for the teamwork. Kahn (2008) posited two types of leadership within student teams. One is that a team member may step forward and take initiative to carry the team. Normally, the person has great ideas regarding the project and has the capability to be neutral or to inspire members to work together. She or he could be the project manager or facilitator in the virtual teams. Another type of leadership that Kahn mentioned is “self-managing” in which team members who are great at critical thinking would take the lead at brainstorming ideas and problem solving. Members who are great at website design can take the lead on portfolio design; members who are great at time management can take the lead on the development of the project timeline. The role of team leader can rotate, and each member can be the leader at a certain type in the project.

Pavitt (2003) described emergent leadership as it is through the interaction of the group; one or more individuals emerged to perform the leadership behaviors of emergent leaders in virtual teams.

Pfaff and Huddleston (2003) mentioned that team leaders provide direction to enable team members to contribute their skills, their ideas, and their perspectives. They need to respect disagreement and divergence from team members. The leaders serve as the “glue” that holds the

team together. Pescosolido (2001) identified the “informal leader” of a team as a member who “exerts influence over other members” and “is chosen by the team” (p. 78). In a study of MBA students, Pescosolido found that teams with an informal team leader performed better than teams with unidentified leaders. Rosen, Furst, and Blackburn (2007) illustrated that the role of leader within virtual teams should include the following aspects: the leader should get to know their team members well enough to understand each of their strengths; the leader should respect team members’ disagreements and divergent insights; the leader should go beyond acting as the model of knowledge sharing and should instead articulate the whole picture of the project; and the leader should provide directions to encourage team members to make their own contributions or to provide their own input.

Knowledge Sharing and Student’s Grades

The benefits of collaborative online interactions have been widely reported. Larkin and Hein (2001) designed their studies to examine the effectiveness of online discussion groups for their students in helping their students understand physics. In their results, they reported that: (1) online discussions provided a flexible environment in which students could share their ideas at different time and locations; (2) online discussions facilitated critical thinking and encouraged knowledge construction; and (3) students became more proficient at transferring and applying what they learned in classes to real life situations.

In addition to understanding whether online interaction had an impact on student learning measured by their final grades, Davies and Graff (2005) conducted a study examining the relationship between the frequency of online interaction and the students’ grades with 122 undergraduates. The results indicated that higher frequency of online interaction did not lead to

significantly higher grades; however, students who failed in their courses had fewer interactions with their peers.

The researcher recognized the importance of team interaction within virtual teams. However, how to measure team interaction is a problem. Nisbet (2004) suggested using quantity and quality of interaction to measure the learning exchanges taking place. Therefore, in order to examine whether higher levels of quality and quantity of knowledge sharing lead to higher grades for students, the current study examined the relationship between the quality and quantity of knowledge sharing with student's grades. In other words, the research wants to see whether students who shared more knowledge had higher scores; and whether students who shared a higher quality of knowledge had higher scores.

The Development of the Knowledge Sharing Model

Nelson and Coopriider (1996) proposed a model that described the casual relationship among mutual trust, mutual influence, knowledge sharing, and team performance. To analyze specific relationships among these constructs, they developed a path model and found the significant path. Their results indicated that mutual trust and mutual influence led to increased levels of knowledge sharing, and increased knowledge sharing was a positive contributor to team performance. In addition, Nelson and Coopriider (1996) indicated in their implications and future research that they had taken a relatively narrow approach to investigate knowledge sharing. They recommended that future studies should include more comprehensive conceptualizations that affect knowledge sharing and team performance.

Based on the knowledge sharing model proposed by Nelson and Coopriider (1996), mutual trust and mutual influence are two factors which affect knowledge sharing and team

performance. Also there is evidence in the literature that other factors, such as team cohesion, conflict, and team leader skills, also influence knowledge sharing within virtual teams. This study extends Nelson and Coopriider’s model by drawing on both Social Interdependence Theory and Expectancy Value Theory to investigate the factors that affect knowledge sharing in terms of quantity and quality within virtual teams in the online learning environment. The researcher proposed the five factors affecting knowledge sharing within virtual teams including: mutual trust, mutual influence, mutual conflict, team cohesion, and team leader skills. In addition, the study examined the relationship between knowledge sharing and students’ grades; in other words, the study investigated if students who share more knowledge also tend to learn more as a result of collaboration. Figure 1 presents the conceptual framework:

Figure 1 A Conceptual Framework for Knowledge Sharing in Virtual Teams

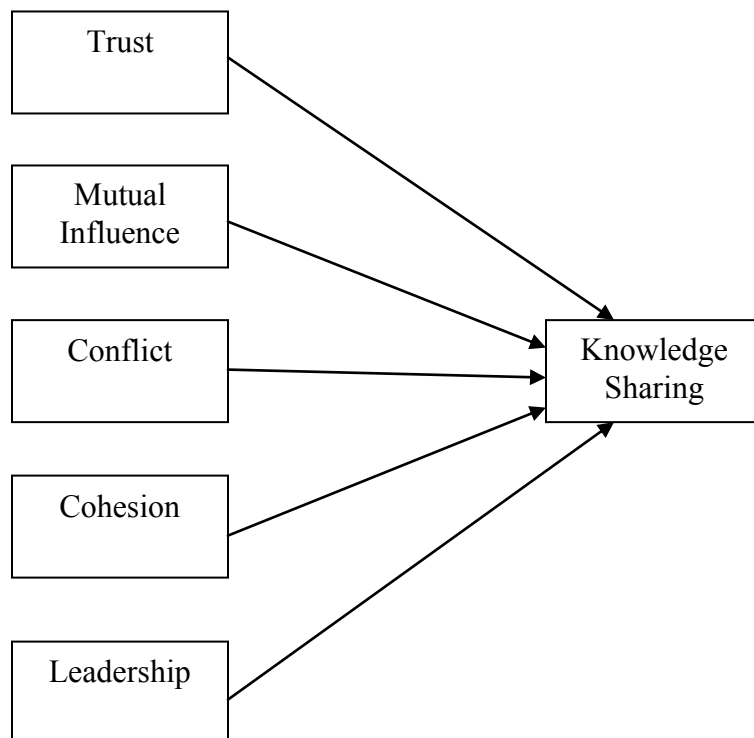
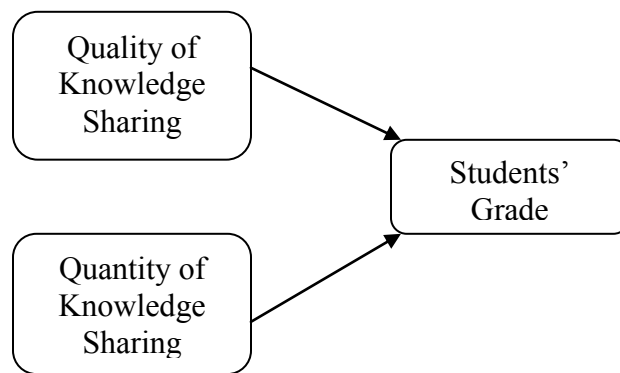


Figure 2 The relationship between quality and quantity of knowledge sharing and students' grades



This model demonstrates that mutual trust, mutual influence, mutual conflict, team cohesion, and team leader skills are associated with knowledge sharing in terms of the quality and quantity of knowledge sharing. In addition, the extent of knowledge sharing is associated with the students learning achievements within virtual teams in an online learning environment.

CHAPTER THREE METHODOLOGY

The main purpose of this study is to determine whether relationships exist among knowledge sharing from asynchronous group discussions and the five factors: mutual trust, mutual influence, conflict, team cohesion and team leader skills. In addition, the researcher examined the relationship between the quality and quantity of knowledge sharing and student's grade. The specific research questions and hypothesis are as follows:

1. Are the five factors that affect knowledge sharing within virtual teams in the online learning environments as represented in the path model consistent with the data collected?
2. To what degree does the *quality* of knowledge sharing impact students' grades within virtual teams?
3. To what degree does the *quantity* of knowledge sharing impact students' grades within virtual teams?

Hypothesis:

1. Trust, mutual influence, conflict, cohesion and leadership will be positively associated with quality of knowledge sharing.
2. Quality of knowledge sharing will be positively associated with students' grade.
3. Quantity of knowledge sharing will be positively associated with students' grade.

Pilot Study

A pilot-test was conducted on October 15th, 2008 by asking 26 doctoral students enrolled in a research seminar class from College of Education at University of Central Florida. After the research received the permission from the instructor, the researcher sent out the survey to the students who indicated they were willing to participate in this study. Respondents were asked to complete the questionnaire and provide detailed comments. Each participant had prior experience working within virtual learning teams. The feedback requested included appropriateness of items to study context, clarity of questions, grammar, overall structure, length of the instrument. Feedback and suggestions from these students were used to modify and refine the questionnaire at the end of the October, 2008. Based on the suggestions from the pilot-test, this researcher made some changes on the question 29 and question 30. (See Appendix C) (Content validity).

Modifications to the Measurement Scale:

Based on the feedback and comments from student participants, this researcher modified the originally proposed survey items measuring mutual influence among team members. Several students who participated in the pilot study commented that question 29 and question 30 were confusing and not clear enough. Questions 29 and 30 attempted to measure students' perceptions on mutual influence within virtual teams, In addition, the original questions asked about the level of the influence, however, the measurement scale used from 1("Strongly Disagree") to 5 ("Strongly Agree"). In order to match the questions to their measurement scales, the researcher modified the perceived mutual influence items to the below statements. The original items 29 and 30 were:

- In general, the level of influence that team members' constant presence in the discussion forums added incentive for continued participation in the discussion.
- In general, the level of the influence those team members' discussion posting affects or shapes my own work.

The new items are:

- In general, other team members' constant presence in the discussion forums added incentive for me to continue participation in the discussion.
- In general, other members' discussion postings affected or shaped my work.

Other Modifications to the Survey

Several of the students who participated in the pilot study mentioned that they did not quite understand the definition of team leader; others reported that they did not have team leaders at all. In order to clarify the role of team leader, this researcher added a definition of team leaders at the beginning of the survey as follows "In virtual teams, normally, there is a person emerging as a team leader who will assign the roles, initiate the discussion, mediated the conflicts and remind the deadlines and assign each members' role to get the project done."

Reliability of the survey

In order to measure the internal consistency of the survey items, Cronbach-alpha Analysis was applied with significant alpha level .05 ($\alpha < .05$). Internal consistency "refers to the consistency with which all the items are measuring the same thing (Krauthwohl, 1998)." This method was used to examine whether the questionnaire items correctly measure knowledge sharing. As a result, the reliability of the questionnaire were statistically significant ($\alpha = .947$,

N=26). Krathwohl (1998) mentioned if a value is higher than .90, it is generally interpreted as highly reliable.

Research Design

This is a correlational research study to examine five factors affecting knowledge sharing within virtual teams in two WebCT courses at the University of Central Florida (UCF). Quantitative and qualitative data were collected through an online questionnaire. Based on a review of the literature, the researcher proposed a conceptual framework for factors affecting knowledge sharing within virtual teams. The five factors include: trust, mutual influence, conflict, team cohesion and leadership. It employs a correlational approach to determine the relationship between these factors and knowledge sharing. Multiple regression analysis and path analysis were used to test the model proposed in this study.

Study Population and Sample

Population

The population in this study consisted of students who were enrolled in either of the two online courses offered during fall 2008 in the Department of Health Management and Informatics at the University of Central Florida. The two courses are: (1) HSA 3222: Long-term Care Administration and (2) HSA 4184 Organization and Management for Health Agencies, total of 191 students enrolled in the two courses.

A total of 125 undergraduate students were enrolled in the class HSA 3222 and 66 students enrolled in class HSA 4184. Students were randomly assigned to teams of three to five

within the HSA 3222 class, forming 30 virtual learning teams and 11 virtual learning teams within the course HSA 4184.

Sample:

Total, there were 148 students who voluntarily participated in this study. The overall response rate was 78%. Of the 125 students from HSA3222, there were 93 students who completed the questionnaires, which generated a 74.4% response rate; 66 students enrolled in course HSA4184, and 55 of them completed the questionnaires, with a response rate for this course of 84.8%.

Of the 148 students participating, 30 students (20.3%) were male and 118 students were female (79.7%). Based on a self their report of their online course experiences, 111 students had taken more than four online courses, 18 students had taken 3 or 4 online courses; 15 students had taken one or two online courses before, only five students said they had not taken any online courses before.

The introduction of the two courses:

The two courses both used virtual teams for online collaborative learning. HSA 3222 “Long-term Care Administration” provides an introduction to the organization, financing, and management of the institutional and community based health and social services that make up the long-term care delivery system. This is a totally online course and students do not require face to face meetings. This course includes seven modules. For each module, students have an assignment. The assignments include short quizzes, journal articles reading reflections, and an online debate. The quiz and journal article reflections are individual assignments.

The online debate is a team project. At the beginning of the semester, four or five students were randomly assigned to a team by the instructor. They may or may not know each other prior to this project. Therefore, for the first assignment, they were required to post a personal introduction on the discussion board to introduce themselves to peers. For debate, 24 teams formed. Total 12 debate topics were defined by the instructor, for each topic; there is a team for “con” side and another team for “pro” side. Pro side argues in favor of the proposition and Con side arguments are for opposing the proposition. Each student in the course was on a debate team and students were randomly assigned to debate teams.

At the beginning of the semester, students were randomly assigned into debate teams. During the first thirteen weeks of the semester, team members got to know each other and a specific debate topic was assigned to each team. Every student on a team was equaled to participate in the preparation for its team’s debate. During the final week of the semester, the debate began. Each team had a private discussion board to strategize for the debate. It was expected that each student would conduct related research, collect resources and share information with teammates using discussion board. Numerous ongoing discussions took place on the discussion boards. In order to ensure the quality of the debate content, library research was the essential part of this project. Each student was required to cite at least five articles in their debate session. The online debate lasted one week: the first two days allocated to the opening statements. The rebuttal phase took place on days three to five. During the final two days, students posted closing arguments. The debate was not just an online argument. It involved research, teamwork, and persuasion skills.

The second course HSA4184 “Organization and Management for Health Agencies” is also a totally online course with virtual online teams. The course explores the specific issues of

the management and organization of healthcare organizations including hospitals, long term care facilities, and medical group practices. For each module, students were required to work as a team on their case study using online discussion boards. The only difference was that the students in this course formed their own online teams. The students found their own teammates instead on the instructor randomly assigning them to be a team.

Student participation in this study was voluntary. Participants were required to provide their NID for identification. With approval by the UCFIRB (See Appendix A), the students were awarded extra points to their final grades if they complete the questionnaire. Prior to participation, students were requested to review the informed consent letter (See Appendix B) which were sent them by e-mail. The consent form explained the procedures of the study and human subjects' right related to this study.

The two courses both used online teamwork for instructional purposes. In this study, students work together as teams on their assignments and the term project. The main activities in each course included readings, asynchronous discussions, projects (case study) and quizzes. Those activities were implemented within each learning module. Asynchronous discussions and case studies are teamwork. A module usually consisted of two or three topics covered by reading, online discussions and case study. For each topic, instructors posted a question or case study scenario, students were required to post their reading reflections or problem solutions, and also they need to respond to their peer students' statements. Email was also used by instructors to response individual questions. Instructors also realized the importance of having an ongoing conversation with the class within virtual teams, in one of the courses, a forum within discussion board called "Ask Dr." also used to answer students' questions. As others may have the same questions, so it was beneficial to let other students read the instructor's answers, feedback and

comments. In addition, the instructors were able to monitor the activities on the team discussion board and provide assistance to them. In order to get to know each other better, all students were required to write two to three paragraphs to introduce themselves to peers. After fifteen weeks of teamwork, members completed their term project. At the end of the semester, team members were asked to complete a survey assessing the following factors: trust, mutual influence, mutual conflict, team cohesion, leader skills and knowledge sharing. Survey research also analyzes the relationships between demographics and other factors related to various virtual teamwork variables. The purpose of this study was to examine the correlation relation between these factors and knowledge sharing behaviors during their semester collaboration.

Measures and Procedures

The courses considered for this research were web-based courses and were completed online. The researcher met with the course instructors prior to the beginning of the course. The researcher sent out letters and invitation e-mails to all students enrolled in these online courses at the end of the semester.

An online questionnaire with six varied scales was sent to all students enrolled in the two courses. Participants were asked to complete the online questionnaire regarding factors affecting knowledge sharing in virtual teams. It contained 35 questions using a five- point Likert scale and 12 other demographic questions. The questionnaire comprises six scales: quality of knowledge sharing, mutual trust, mutual influence, mutual conflict, and team cohesion and team leader skills. The researcher adapted the existing scales to access all of the variables: mutual trust, mutual conflict, team cohesion and team leader skills except the mutual influence. Mutual influence was measured by a five-point scale. Each of the scale is described in the following

sections. This researcher sent an invitation e-mail to the class with the URL asking students to complete the questionnaire. The invitation email included a brief description of the research and a link to a secure website to access the online questionnaire – shown in Appendix D. The initial e-mail was sent out one month before the end of the semester and a follow-up e-mail was sent out one week after the first one sent out.

Instrumentation

Instruments were adapted from the literature. Mutual trust, mutual conflict, team cohesion and team leader skills were measured by the adapted scales. Mutual influence was measured by the definition through a five-point scale. The whole questionnaire was combined into five subscales to test the model that factors affecting knowledge sharing within virtual teams (shown in Appendix C).

The dependent variables in this study are two characteristics of knowledge sharing. The study examined the quantity of the knowledge sharing and the quality of the knowledge sharing based on the students' posting on the discussion board via WebCT. The researcher examined the quantity of knowledge sharing based on the total amount of response messages which related to the assignment or project topics posted by each individual.

Demographic Questionnaire

The first part of the survey included demographic questions. The purpose of this section was to determine the number of members of each team, the gender, age, ethnic groups of team members. In order to gain information on the individual's experience on online courses, they

were asked how many times they have taken online courses before. Further, they were asked have they worked with virtual teams before and how many times they worked in virtual teams. Finally, students were asked about how many times they have met face to face on their team work, and the frequency with the tools they used for sharing knowledge with their fellow team members.

Quality of Knowledge Sharing

The quality of knowledge sharing was examined by the scale adapted from DeLone and McLean (2003). These items measured six attributes of the content of the shared knowledge: relevance, ease of understanding, accuracy, completeness, reliability, and timeliness. The composite reliability of this scale was 0.92 (DeLone & McLean, 2003).

Table 2: Quality of Knowledge Sharing

Quality of Knowledge Sharing (DeLone & McLean, 2003)	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable
KS1: The knowledge shared by team members in the discussion board is relevant to the topic.	1	2	3	4	5	N/A
KS2: The knowledge shared by team members in the discussion board is easy to understand.	1	2	3	4	5	N/A
KS3: The knowledge shared by team members in the discussion board is accurate.	1	2	3	4	5	N/A
KS4: The knowledge shared by team members in the discussion board is complete.	1	2	3	4	5	N/A
KS5: The knowledge shared by team members in the discussion board is reliable.	1	2	3	4	5	N/A
KS6: The knowledge shared by team members in the discussion board is timely.	1	2	3	4	5	N/A

Independent Variables

Trust:

The trust dimension measuring interpersonal and communication skills that lead to getting to know and trust others and manage conflict. Trust was measured with a four item scale developed by Jarvanpaa and Leidner (1999) for use in virtual team environment. Samples of this scale included, “Overall, the people in my team are very trustworthy” and “We are considerate of one another’s feelings on this team.” Possible responses range from 1=strongly disagree to 5=strongly agree. In their case study, three hundred and fifty master program students from 28 universities participated in the study. The alpha coefficient was reported as .92 (Jarvenpaa & Leidner, 1999).

Table 3 Trust

Mutual Trust(Jarvenpaa, 1999)	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable
MT1: Overall, the people in my team are very trustworthy.	1	2	3	4	5	N/A
MT2: We are usually considerate of one another’s feelings on this team.	1	2	3	4	5	N/A
MT3: The people in my team are friendly.	1	2	3	4	5	N/A
MT4: I can rely on other members of my team.	1	2	3	4	5	N/A

Conflict:

Conflict was measured adapted the scale developed by Jehn (1995). In his study to examine the relationship between the conflict and team performance, he conducted regressions to

test the proposed hypotheses about conflict and performance. He found that task conflict was positively correlated to decision quality, decision understanding and decision acceptance. The task conflict was defined by Jehn (1999) as: “the disagreement of divergence that occurs when team members process different ideas, opinions, goals, or information about the task.” The original items used a five-point Likert scale, with responses that ranged from 1 as “Strongly Disagree” to 5 “Strongly Agree”. Their items included: “How often did people in your workgroup have conflicting opinions regarding the work being done?”; “How frequently are there conflicts about ideas in your work unit?” “How much conflict about the work you do is there in your work unit?” and “To what extent are there differences of opinion in your work unit?” The Cronbach’s alpha for their conflict scale was .94. (Jehn, 1999)

Table 4: Mutual Conflict

Mutual Conflict (Jehn, 1999)	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable
MC1: Members of my team express different opinions about what we must do on the teamwork.	1	2	3	4	5	N/A
MC2: Members of my team express different opinions about the goal of the teamwork.	1	2	3	4	5	N/A
MC3: Members of my team express different opinions about the project related to tasks.	1	2	3	4	5	N/A
MC4: Members of my team express different opinions about the project related tasks.	1	2	3	4	5	N/A

Team Cohesion:

Team cohesion measured the nature and quality of the emotion bonds of friendship such as liking, caring, and closeness among team members. Team cohesion scale was adapted from Chang and Bordia's team cohesion's scale (2001). The scale contained four items. Sample items included, "My team members are united in trying to reach the goal for performance" and "My teammates try to help if one of the team members has problems." Chang and Bordia (2001) conducted a study to investigate the relationship between the group cohesion and group performance. Eighty students from a 3rd year organizational psychology course participated in their study on a voluntary basis. The results supported that team cohesion was the predictor of the group performance. The test-retest reliability for the task cohesion scale was .73 (Chang and Bordia 2001).

Table 5: Team Cohesion

Team Cohesion (Chang & Bordia, 2001)	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable
TC1: My team members are united in trying to reach the goal for performance.	1	2	3	4	5	N/A
TC2: My team members are responsible for any mistake regarding to the task.	1	2	3	4	5	N/A
TC3: My teammates try to help if one of members has problems.	1	2	3	4	5	N/A
TC4: My team communicates freely about each other's responsibility.	1	2	3	4	5	N/A

Team Leader Skills:

Team leader skills were measured by Team Leader Assessment (TLA) development by Parker (1998). The instrument was designed to assess team leadership effectiveness in a number of areas related to the process side of their responsibilities. TLA focuses on interpersonal behaviors such as: communication, openness, support and encouragement. Sample items include: “Our team leader treated team members with respect and dignity” and “Our team leader communicated all necessary information about the discussion topic in an effective manner. A total of 10 items were measured on a five-point Likert scale with 1 as “Strongly Disagree,” 2 as “Disagree”, 3 as “Neither Agree Nor Disagree”, 4 as “Agree”, 5 as “Strongly Agree”, N/A as “Not Applicable”.

Table 6: Team Leader Skills

Team Leader Assessment (Parker, 1998)	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable
TL1: My team leader treated team members with respect and dignity.	1	2	3	4	5	N/A
TL2: My team leader communicated all necessary information about the discussion topics in an effective manner.	1	2	3	4	5	N/A
TL3: My team leader encouraged team members to offer differing points of view on how they feel the team should function.	1	2	3	4	5	N/A
TL4: My team leader helped the team get the resources required so that we can meet the needs of the course requirement.	1	2	3	4	5	N/A
TL5: My team leader understood team members' needs.	1	2	3	4	5	N/A
TL6: My team leader helped promote self-direction among team members.	1	2	3	4	5	N/A
TL7: My team leader communicated work objectives and other directions clear and obtainable.	1	2	3	4	5	N/A
TL8: My team leader recognized and rewarded outstanding performance and extraordinary efforts.	1	2	3	4	5	N/A
TL9: My team leader promoted open and honest communication on the team.	1	2	3	4	5	N/A
TL10: My team leader provided useful feedback to members about the performance.	1	2	3	4	5	N/A

This questionnaire included three parts: 35- item questionnaire asked about the factors affecting knowledge sharing within virtual teams, 12 demographic items and one open ended question on students experience within virtual teams. For each item in this 35-item questionnaire, students were asked to choose one level on a 5-point Likert scale (1= Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4= Agree, 5= Strongly Agree, 0= Not Applicable). The

12 demographic items asked students about their previous experience with online courses, online teamwork, student's status, ethnics, gender and age.

Data Collection Procedures

Prior to gathering any data, the University of Central Florida Internal Review Board (IRB) examined the survey to ensure that it met the university's requirements for human subject research. This review assures that the rights and welfare of the human subjects are protected. After IRB approved the survey and all subsequent modifications, the data collection will begin. The participation in this study is voluntary and individual responses will be kept confidential.

Once this study validated the survey, the survey was posted online using Formmanager through a link directed posted in the WebCT. A web link to an informed consent letter was sent to students. Students were advised by clicking the "go to the survey" link if they agreed to participate voluntarily in this study. Otherwise they can close the window if they did not want to take the survey. The online questionnaires were developed by Macromedia Dreamweaver and Form Manager hosted by College of Education at UCF was used to database management. Therefore, the respondents' data were successfully stored in the Form Manager server.

In order to encourage students to participate in the survey research study, Participants who complete the study were given ten extra points by their course instructor. The students' identities were kept confidential. All analyses would be done in a manner with no identification of any individual except for asking for their NID to give extra points if they complete the survey.

The data collection period began from November 10th, 2008 to December 1st, 2008. This researcher first sent an invitation email on November 10th, 2008 to all students enrolled in these two classes to ask for their support in an important research project. The participants received a

follow up reminder about one week after the initial contact. After collecting the data, the data was analyzed.

Data Analysis Procedures

After collected data, they were coded and analyzed using SPSS. Data analysis used multiple regression and path analysis to test the conceptual framework (shown in Figure1). The analysis is presented in three parts. First, the researcher tested whether the identified factors affect knowledge sharing within virtual teams. Next, the researcher analyzed whether there was some relationship between the quantity of knowledge sharing as well as the qualities of knowledge sharing and the students learning achievement. Finally, the researcher analyzed whether the proposed model is acceptable. It is hypothesized this study that mutual trust, mutual influence, mutual conflict, team cohesion and team leader skills would be related to the extent to the quantity of knowledge sharing and quality of knowledge sharing. Also the quantity of knowledge sharing and quality of knowledge sharing would be associated with learning achievements. These relationships were represented in a path analysis. The following research questions and hypothesis will be used for the purposes of the statistical analysis:

1. Are the five factors affecting knowledge sharing within virtual teams in the online learning environment as represented in the path model consistent with the data collected?
2. To what degree does the *quality* of knowledge sharing have an impact on students' grades within virtual teams?
3. To what degree does the *quantity* of knowledge sharing have an impact on students' grades within virtual teams?

Hypothesis:

1. Trust, mutual influence, conflict, cohesion and leadership will be positive associated with quality of knowledge sharing.
2. Quality of knowledge sharing will be positive associated with students' grade.
3. Quantity of knowledge sharing will be positive associated with students' grade.

Summary

This is a correlational research study to examine the factors affecting knowledge sharing within virtual teams at university of Central Florida (UCF). Quantitative and qualitative data were collected through an online questionnaire. Based on the literature review, the researcher proposed a conceptual framework on factors affecting knowledge sharing within virtual teams. The five factors include: trust, mutual influence, conflict, team cohesion and leadership. It employs a correlational approach to determine the relationship between these factors and knowledge sharing. One hundred and forty nine students voluntarily participated in this study. An online questionnaire with six subscales was administrated during Fall 2008 semester. Multiple regression analysis and path analysis were conducted to test the model proposed in this study.

CHAPTER FOUR RESULTS

Introduction

The main purpose of this study is to evaluate a path model of knowledge sharing within virtual teams specifying the relationships between mutual trust, mutual influence, conflict, team cohesion, team leader skills and knowledge sharing. In addition, the study will examine the relationship between knowledge sharing and students' grades within virtual teams. In the context of the path analysis, the following research questions will be answered for the purposes of the study:

1. Are the five factors that affect knowledge sharing within virtual teams in the online learning environments as represented in the path model consistent with the data collected?
2. To what degree does the *quality* of knowledge sharing impact students' grades within virtual teams?
3. To what degree does the *quantity* of knowledge sharing impact students' grades within virtual teams?

Hypothesis:

1. Trust, mutual influence, conflict, cohesion and leadership will be positively associated with quality of knowledge sharing.
2. Quality of knowledge sharing will be positively associated with students' grade.
3. Quantity of knowledge sharing will be positively associated with students' grade.

Description of Sample

Of 191 students enrolled in the two courses, HSA3222, Long-term Care Administration and HSA4184 Organization and Management for Health Agencies. Total 148 of them completed the online questionnaire. The response rate was 78%. Descriptive results show that the majority (79.7%) of the participants were female. Only 20.3% of participants were male (See Table 7).

Table 7: Gender

Variables	HSA 3222		HSA 4184		TOTAL	
	Sum	Percent	Sum	Percent	Total	Percent
	93		55		148	
Gender						
Female	71	76.3	47	85.5	118	79.7
Male	22	23.7	8	14.5	30	20.3

HSA3222 is the course name
HSA4184 is the course name

Age

As far as the participants' age, 1.3% of the students were under 18 years old; 63.8% of students were between 19 to 24 years old; 16.1% of students were between 25 to 29 years old; and only 18.8% of students were above 30 years old (see Table 8).

Table 8: Age

Variables	HSA 3222		HSA 4184		TOTAL	
	Sum	Percent	Sum	Percent	Total	Percent
	93		55		148	
Age						
<= 18	2	2.2			2	1.3
19-24	57	61.3	38	67.9	95	63.8
25-29	19	20.4	5	8.9	24	16.1
>=30	15	16.1	13	23.2	28	18.8

HSA3222 is the course name
HSA4184 is the course name

Participant's Age

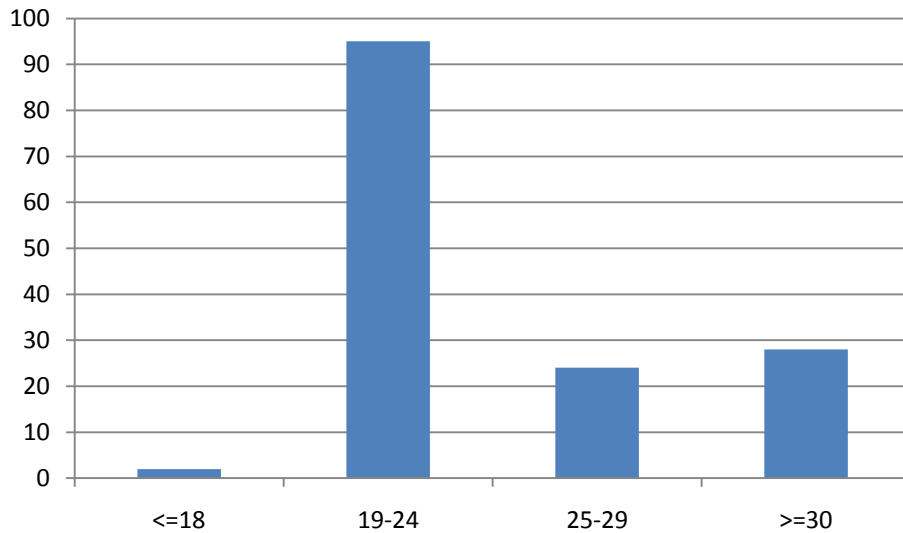


Figure 3: Bar Chart for Participant's Age

Ethnicity

With respect to the ethnicity, over 51.4% were white, 25% were African American. 15.5% were Hispanic, 6.8% were Asian, and only 1.4% was Pacific (see Table 9).

Table 9: Ethnicity

Variables	HSA 3222		HSA 4184		TOTAL	
	Sum	Percent	Sum	Percent	Total	Percent
	93		55		148	
Ethnicity						
White	52	56.5	24	42.9	76	51.4
African American	20	21.7	17	30.4	37	25
Asian	7	7.6	3	5.4	10	6.8
Pacific	1	1.1	1	1.8	2	1.4
Hispanic	12	13	11	19.6	23	15.5

HSA3222 is the course name
HSA4184 is the course name

Participant's Ethnicity

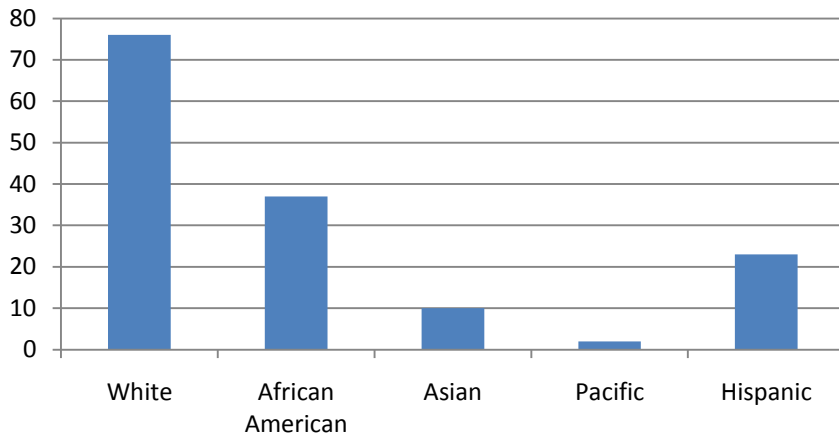


Figure 4: Bar chart for Participant's Ethnicity

Students Online Course Experiences

In terms of their online course experiences, 74.5% of the students had taken more than four online courses before, 12.1% of the students had taken three or four times online courses, 10.1% of them had taken one or two online courses before, and only 3.4% of the students did not take any online courses before (see Table 10).

Table 10: Students Online Course Experiences

Variables	HSA 3222		HSA 4184		TOTAL	
	Sum	Percent	Sum	Percent	Total	Percent
	93		55		148	
Times taken Online Courses before						
None	5	5.4			5	3.4
1-2 times	15	16.1			15	10.1
3-4 times	13	14	5	8.9	18	12.1
>4 times	60	64.5	51	91.1	111	74.5
English is native language						
Yes	81	87.1	47	83.9	128	85.9
No	12	12.9	9	16.1	21	14.1

HSA3222 is the course name
HSA4184 is the course name

Student Virtual Team Experiences

When asked about their virtual teaming experiences prior to the current course, 53.7% of students reported that they had not had any virtual teaming experiences before (See Table 11).

Table 11: Student Virtual Team Experiences

Variables	HSA 3222		HSA 4184		TOTAL	
	Sum	Percent	Sum	Percent	Total	Percent
	93		55		148	
Experience with this team before						
Yes			5	9.1	5	3.4
No	93	100	50	90.9	144	96.6
Times worked in virtual team before						
None	57	61.3	23	41.1	80	53.7
1	18	19.4	12	21.4	30	20.1
2	6	6.5	14	25	20	13.4
≥ 3	12	12.9	7	12.5	19	12.8
Times met face to face						
None	89	96.7	49	87.5	138	93.2
1	2	2.2	7	12.5	9	6.1
2	0	0			0	0
≥ 3	1	1.1			1	0.7

Online Communication Tools

To understand what kind of communication tools the students used the most frequently to share knowledge with their fellow students, the researcher asked them to indicate the frequency with which they used the communication tools to exchange information with their teammates. The scale ranged from 4 = daily, 3 = a few times a week, 2 = once a week, 1 = once a month, and 0 = not applicable. Students reported that the discussion board and emails were most often used

to share information, followed by sharing databases personal telephone calls, and group telephone conferences. The mean score for each communication tools used is shown in Table 12.

Table 12: Mean Ratings of Frequency of Use of Communication Medium (N=148)

Communication Tools	Means	STD
Personal telephone call	.28	.747
Email	1.57	1.277
Webcourses Discussion Board	2.81	.852
Group telephone conference	.03	.232
Video Conference	.00	.000
MSN	.05	.376
Shared Database	.39	.942

The following Figure 5 gives a visual representation of the frequency of use of communication tools.

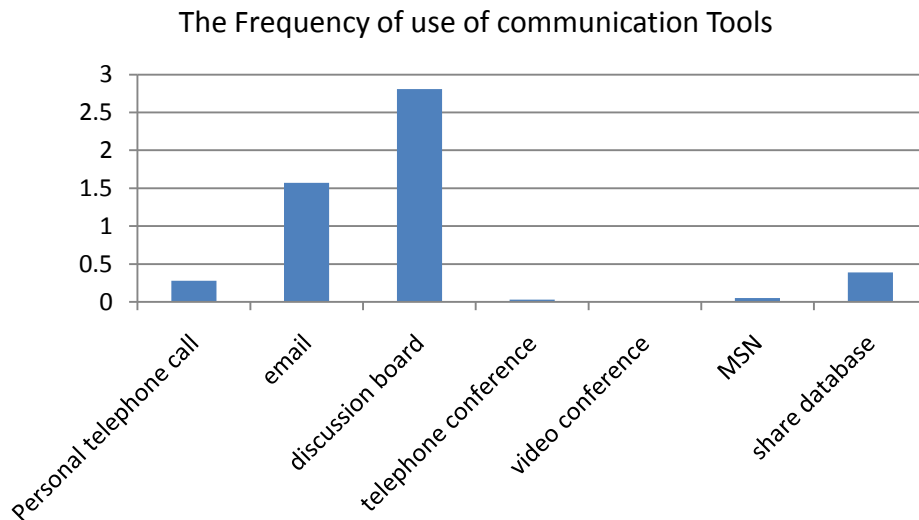


Figure 5 Bar Chart for Communication Tools

Reliability Evidence

Six subscales were adapted from the literature that included: trust, quality of knowledge sharing, mutual influence, conflict, team cohesion and leadership. There are a total of 35 items on the scale. An internal consistency reliability testing was conducted for these six subscales using SPSS: Table 13 shows the results. The Cronbach Alpha Coefficients of the six scales are represented in Table 13. The results show that all of the coefficients are more than .90 except for mutual influence scale.

Table 13: Internal Consistency Reliability Testing

Cronbach Alpha for Instruments	
Knowledge sharing	.905
Trust	.905
Mutual Influence	.832
Conflict	.944
Team Cohesion	.917
Leadership	.981

Validity (Interned Structure Evidence)

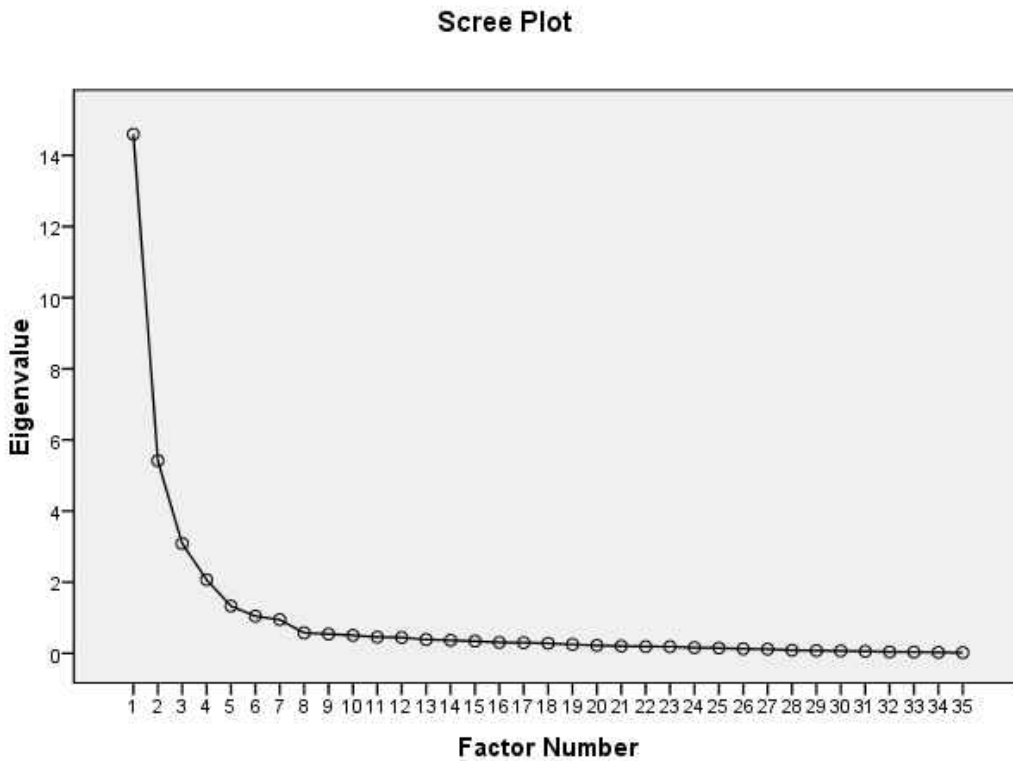
The six subscales were adapted from the literature; an exploratory factor analysis was conducted to examine the discriminated validity of the scales. The six subscales include quality of knowledge sharing (items 13 to 18), trust (items 25 to 28), mutual influence (items 29 to 30), conflict (items 31 to 34), team cohesion (items 35 to 37), and leadership (items 39 to 47).

Table 19 in appendix E presents the result of exploratory factor analysis.

To examine how many factors to extract, initial eigenvalues for each factor were used to help guide in determining how many factors can be extracted. The maximum likelihood estimation procedure was used for estimation. Kaiser's rule was used to extract the factors most eligible for interpretation because this rule requires that a given factor is capable of explaining at least the equivalent of one variable's variance. In this study, the first six factors evidenced eigenvalues above 1. These six factors explain a total of 78.68% of the variance (See Table 19 and Table 20 in appendix E).

A screeplot provided by SPSS also tells us how many factors are extracted. There is quite a clear break after the sixth component. Components one to six explain or capture much more of the variance than the remaining components (See Figure 6).

Figure 6: Scree Plot



Six factors (See Table 19 in appendix E) were extracted from the exploratory factor analysis: trust, quality of knowledge sharing, team conflict, leadership and team cohesion, except two items, item 26 and item 28 were not clustered with factor trust. Both items were still kept in the subscale for trust.

Research Question One

Are the five factors affecting knowledge sharing within virtual teams in the online learning environment as represented in the path model consistent with the data collected?

To answer this question, the researcher conducted a multiple regression analyse to explore the direct and indirect relationships among knowledge sharing and the five factors. First the researcher conducted a multiple regression analysis to examine the relationship among knowledge sharing and the five predictors: trust, mutual influence, conflict, cohesion and leadership; second, the researcher conducted a regression analysis to determine the relationship between trust and conflict; lastly, the researcher examined the relationship between leadership and cohesion.

Path Analysis of the Proposed Model

The results of this correlations analysis are presented in Table 14. All of the correlations were statistically significant. For the first research question, the correlation coefficient between mutual influence and knowledge sharing is significant ($r = .55, p < .001$). The correlation coefficient between trust and conflict is significant ($r = .16, p < .05$). Leadership is significant correlated with cohesion ($r = .41, p < .001$). Conflict towards knowledge sharing hypothesized as mediator variable in this study, shows significant correlation with knowledge sharing ($r = .25, p < .01$). Cohesion is significantly correlated with knowledge sharing ($r = .72, p < .001$).

Table 14: Correlation:

		Correlations					
		QK	trust	influence	conflict	cohesion	leadership
Pearson Correlation	QK	1.000	.647	.548	.250	.722	.385
	trust	.647	1.000	.552	.163	.789	.355
	influence	.548	.552	1.000	.195	.491	.261
	conflict	.250	.163	.195	1.000	.221	.202
	cohesion	.722	.789	.491	.221	1.000	.412
	leadership	.385	.355	.261	.202	.412	1.000
Sig. (1-tailed)	QK	.	.000	.000	.002	.000	.000
	trust	.000	.	.000	.029	.000	.000
	influence	.000	.000	.	.011	.000	.001
	conflict	.002	.029	.011	.	.005	.009
	cohesion	.000	.000	.000	.005	.	.000
	leadership	.000	.000	.001	.009	.000	.
N	QK	136	136	136	136	136	136
	trust	136	136	136	136	136	136
	influence	136	136	136	136	136	136
	conflict	136	136	136	136	136	136
	cohesion	136	136	136	136	136	136
	leadership	136	136	136	136	136	136

Regression analyses were performed to determine path coefficients for the following direct and indirect relationships among these variables. 1) A multiple regression was used to determine how well a set of variables: trust, mutual influence, conflict, team cohesion and leadership are able to predict knowledge sharing. 2) The relationship between trust and conflict; 3) the relationship between leadership and cohesion. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, and multicollinearity.

Table 15: Model Summary

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.764 ^a	.584	.568	3.050

a. Predictors: (Constant), leadership, conflict, influence, cohesion, trust

b. Dependent Variable: QK

The relationship among the five factors and knowledge sharing:

The results show that the combination of the five predictors are significantly predictors of knowledge sharing ($R^2 = .584$, %, $F(5, 130) = 36.58$, $p < .001$) (see table 15 and table 16). The combination of predictors explains 58.4% of variance in subjects' knowledge sharing.

Table 16: ANOVA

ANOVA ^b						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1700.261	5	340.052	36.557	.000 ^a
	Residual	1209.268	130	9.302		
	Total	2909.529	135			

a. Predictors: (Constant), leadership, conflict, influence, cohesion, trust

b. Dependent Variable: QK

Of the standardized regression coefficients (see Table 17) used to determine the independent contributions of each of the five predictors, only two measures were statistically significant. In other words, only mutual influence and team cohesion can directly predict knowledge sharing. Team cohesion appears to make the most significant contribution to knowledge sharing ($\beta = .482$, $p < .001$). Mutual influence is the next variable that directly affects

knowledge sharing ($\beta = .218, p < .05$). Trust, leadership and conflict do not have significant sole contributions. The results indicate that the variance of the criterion variable is contributed mainly by team cohesion and mutual influence.

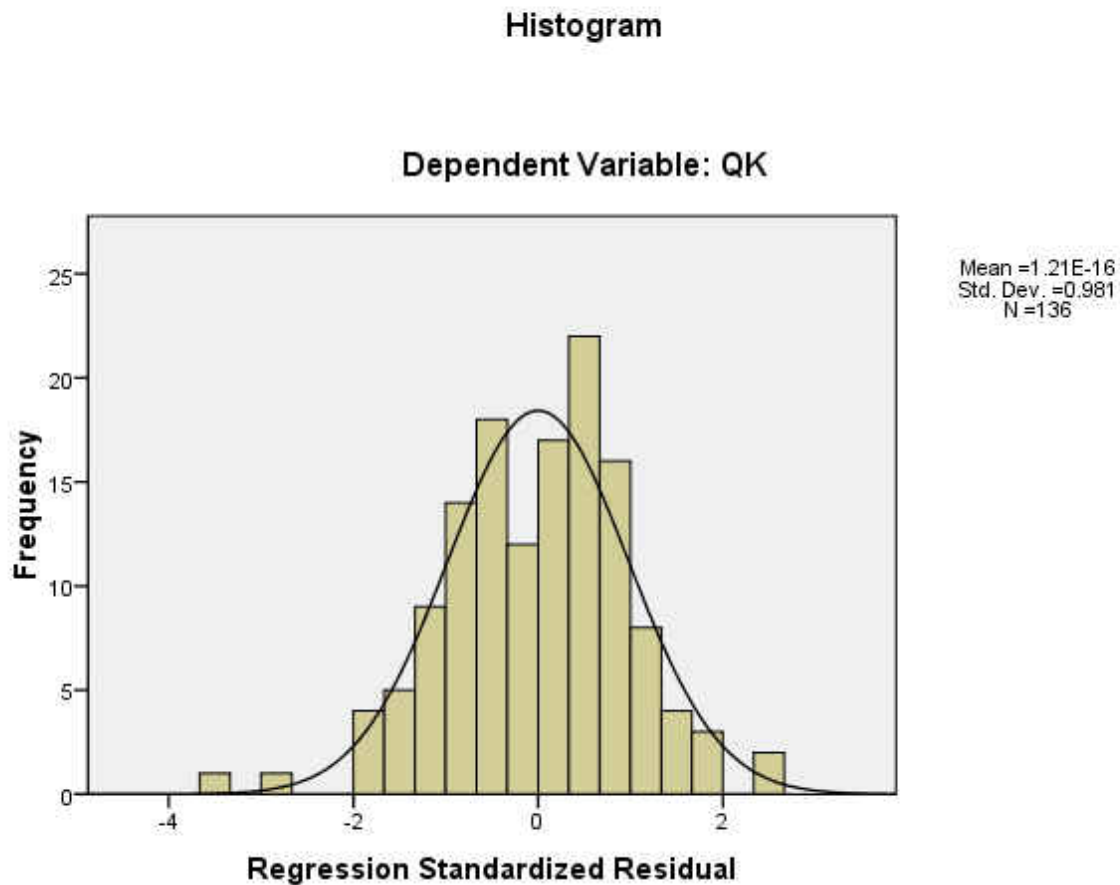
Table 17: Standardized Coefficients

Coefficients ^a										
Model		Unstandardized		Standardized		95% Confidence		Collinearity		
		Coefficients		Coefficients		Interval for B		Statistics		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	10.457	1.143		9.151	.000	8.196	12.718		
	trust	.117	.105	.108	1.112	.268	-.091	.325	.341	2.934
	influence	.442	.139	.218	3.177	.002	.167	.718	.677	1.478
	conflict	.066	.058	.067	1.145	.254	-.048	.181	.925	1.081
	cohesion	.629	.125	.482	5.053	.000	.383	.876	.351	2.851
	leadership	.022	.018	.078	1.243	.216	-.013	.058	.813	1.230

Dependent variable:
knowledge sharing

An examination of the VIF for each predictor suggested that the multicollinearity was not a problem in this path analysis as all VIF values were less than 10. Furthermore, a review of the histogram of the standardized residual suggested that the scores are normally distributed (another assumption made in such an analysis (see figure 7))

Figure 7: Histogram



2) The relationship among knowledge sharing and the five predictors

The researcher conducted a multiple regression analysis to examine the relationship among knowledge sharing and the five predictors: trust, mutual influence, conflict, cohesion and leadership. The path model of these relationships was shown in Table 18 and Figure 8:

Table 18: Path Model for Each Endogenous Variable

Endogenous variables	Exogenous variables	β	Std Err	t	R^2
Knowledge sharing	Mutual influence	0.552***	0.144	7.862	0.305
	Conflict	0.239**	0.076	2.979	0.24
	Cohesion	0.715***	0.075	12.36	0.51
Conflict	Trust	0.194*	0.094	2.36	0.037
Cohesion	Leadership	0.45***	0.017	6.01	0.203

* the level of $p < .05$;

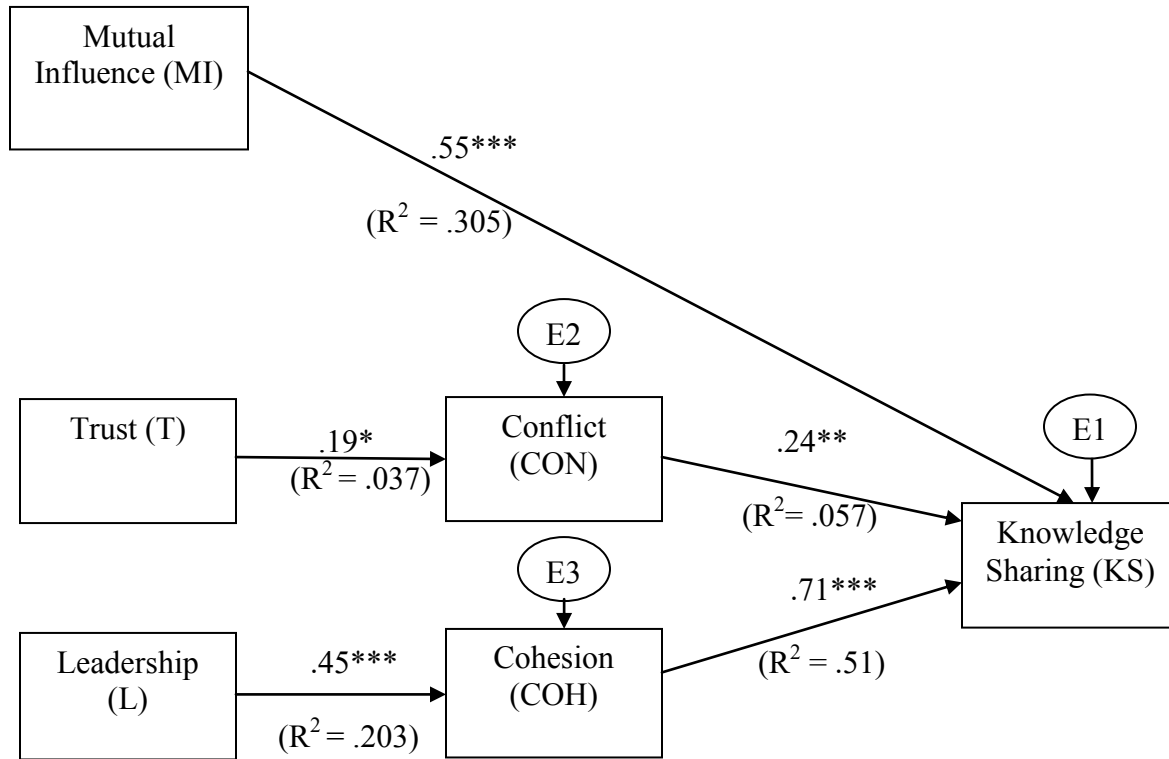
**the level of $p < .01$;

***the level of $p < .001$

Standardized regression coefficients shown as β in the table 18 were used to evaluate the model proposed in this study. They are interpreted as direct path coefficients between the two corresponding variables. Figure 8 is the path diagram that is based on the multiple regression analysis.

Directly answering the research question one, the results are presented at Table 18 and Figure 8. Mutual influence is significant related to the knowledge sharing ($R^2 = .305$, $F(1, 141) = 61.8$, $p < .001$). The relationship between trust and conflict was of statistical significance ($R^2 = .037$, $F(1, 143) = 5.569$, $p < .01$). That is only 3.7 % of the variance in subjects' conflict was associated with trust. Conflict and knowledge sharing was of statistical significance ($R^2 = .057$, $F(1, 146) = 8.87$, $p < 0.01$). Leadership is significant related to cohesion ($R^2 = .203$, $F(1, 142) = 36.14$, $p < .001$). The relationship between cohesion and knowledge sharing was of statistical significance ($R^2 = .51$, $F(1, 146) = 152.7$, $p < .001$). There are 51% of the variance in subjects knowledge sharing was associated with cohesion.

Figure 8: Path model for knowledge sharing



* $t > 1.96$ (the level of $p < .05$);
 ** $t > 2.58$ (the level of $p < .01$);
 *** $t > 3.30$ (the level of $p < .001$)

The path model proposed here was revised based on the empirical results. This revised model illustrated the direct and indirect relationships among five factors and knowledge sharing. The difference between the revised model and the previous model in chapter one is that: trust does not directly affect knowledge sharing, trust affects knowledge sharing mediated by task conflict; and leadership does not directly affect knowledge sharing, and leadership affects knowledge sharing mediated by cohesion.

A path analysis was conducted to examine the direct and indirect relationships between and among knowledge sharing and each of these factors: trust, mutual influence, conflict, leadership and team cohesion. Figure 8 presented the path diagram which shows the path coefficients and error variances. The numbers in the parentheses are correlation coefficients between each variable. There are five exogenous variables and three endogenous variables explained by one or more of the variables in this model. The researcher conducted three sets of regression analyses with the three endogenous dependent variables. There are several significant causal relationships represented in the diagram. Mutual influence had a significant path relationship with knowledge sharing ($\beta = .55$, $p < .05$). Trust had a significant path relationship with conflict ($\beta = .19$, $p < .05$) which had a relationship with knowledge sharing ($\beta = .24$, $p < .05$). In addition, leadership had a strong relationship with team cohesion ($\beta = .45$, $p < .05$) which then had a relationship with knowledge sharing ($\beta = .71$, $p < .05$).

Research Question Two

To what degree does the **quality** of knowledge sharing have an impact on students' grades within virtual teams?

The question examined the relationship between the quality of knowledge sharing and the students' learning achievement. The students' learning achievement was represented by the grades for individual students. A multiple regression analysis ($F(1, 129) = .101$, $p > .05$) indicated there is no statistical significance between these two variables. In this study, the researcher hypothesized that quality of knowledge sharing had an impact on students' grade. However, the results show there is no relationship between quality of knowledge sharing and the

students' grade. This does not support the assumption that higher quality of knowledge sharing leads to better grades, but is the amount of knowledge sharing or postings impact on higher achievement?

Research Question Three

To what degree does the **quantity** of knowledge sharing have an impact on students' grades within virtual teams?

The question concerns the relationship between the quantity of knowledge sharing and the students' learning achievement. The students' learning achievement was represented by the grades for individual students. Quantity of knowledge sharing was measured by the number of postings that each student posted on the discussion board. A multiple regression analysis ($R^2 = 7\%$, $F(1, 125) = 10.4$, $p < .05$) indicated quantity of knowledge sharing had a significant relationship with student's grade; there was 7% variance in student's grade which can be explained by the quantity of knowledge sharing. The result showed students who interacted and participated more in online discussion achieved higher grades.

Qualitative Data Analysis

In order to provide further insights towards the implications of the quantitative data analysis and strengthen possible interpretations, the researcher analyzed the qualitative data from the open-ended question from the survey. The question asked about the student's overall experience with their virtual teamwork. There are 54 students who provided their comments and feedback on this question. The qualitative data collected from the open-ended question provided additional understanding of the extent of these relationships. These excerpts shed further light on the first research question. The researcher categorized the students' comments and feedback into

five schemes based on identified factors; they include: mutual influence, trust, conflict, cohesion, and leadership.

Mutual influence

Mutual influence was defined by Anderson & Narus (1990) as the degree to which the ability of virtual team members affects each other when executing tasks. More specifically, it is defined as what degree that the students' constant presence in the discussion board added incentive for others continue participation in the discussion, and whether students' discussion postings affect or shape others' work. The students' responses focused on their attitude towards the virtual team work and how their peers' behaviors affected other members' performance.

Following are statements from students that revealed supported for the researcher's quantitative findings:

Virtual team work is very fun, and it would make me enjoy the course more. I personally never like to take online course, but I have to. I am glad it works well for me. Sometimes I forgot to even go on the course website to complete my work online. But working as a team to achieve a best grade in the class, would make me want to come in and discuss about my work.

I think virtual team is cool. It help a lot especially when it comes to asking questions about assignment or other things that I or other student are confused about. I am surprised the amount of responses to the questions that other student or myself post on here. They are very helpful and I am glad to know that there are helpful people out there.

What they thought about the case studies and then all of our answers were combined. I feel by doing this it created better work than if we would have all done it individually. As with the project we each put the same amount of work into the project and everyone made some corrections once it was complete. Having the virtual team made me feel like ultimately my grade would be better than if I was doing the work by myself.

Trust

Trust is another factor affecting knowledge sharing within virtual teams. Based on Anderson & Narus (1990), trust was defined as the degree to which a virtual team member believes his/her partners work well with each other. In those successful teams that team members feel satisfied with their teamwork, students' response can reflect that trust was developed among team members. Members in those teams have a sense of safety to speak honestly to their peers. They believe in other members and they think their members will work hard. They have confidence to work great on their team projects.

On the contrary, in those teams that failed to build trust, members felt frustrated and they do not believe on each other's intentions. They doubt on other's competence and they cannot find trustworthy from each other. In virtual teams, most of the students do not know each other before, students normally are uncertain about how much they can trust each others when they first work as in virtual teams. However, from some behaviors and students' attitude, team members might have some judgment on their members. For instance, how the team members care about their project? Will the students do whatever they promised to do? Will the students provide feedbacks and make any contributions? If the answers for all of these questions are positive, students may begin to trust their team members at first. Some students mentioned that they enjoyed the virtual teamwork for a variety of reasons; one of the reasons they mentioned is that "their team members were trustworthy." This was reflected in their statements:

I enjoyed it, usually I hate group work, but this time around I found that my teammates were able to take on responsibility and that made it work.

All my team members were trustworthy and turned in their parts to assignments in a timely matter. Although there were different opinions and some animosity within the group, we pulled together to complete the assignments we had to do. We made compromises until we all agreed on the same thing.

Virtual teamwork is great because it builds trust between total strangers and allows people to work with others efficiently.

Conflict

While students enjoy the virtual teams since they feel flexibility and they can learn different perspectives when solving problems, several students still complained that there was conflict in their teams. The conflict may arise from the different attitude or problem solving approaches, such as, whether or not meet face to face in virtual teams, the extent to which team members can control the decision on the project. So the critical thing here is how team members can face the conflict.

The emergent conflict literature reflects that there are two types of conflict: relationship conflict and task conflict (Panteli & Sockalingam, 2005). Relationship conflict focused on interpersonal incompatibilities or disputes, which provokes hostility, distrust, cynicism and other negative emotions. Task conflict is generally task oriented and is focused on disagreement or divergence that occurs when team members possess different ideas, opinions or information about the task (Jehn, 1995). From the qualitative data of this study, students' complaints regarding conflict include: social loafing, misunderstanding and untimely postings.

I personally do not like working in groups for classes. It's not that I'm opposed to working in groups because I work in groups at work etc, but it's completely different in the classroom environment. It's just that it always turns out that some do the majority of the work while others don't pull their weight. So, the ones that did not do the majority of the work end up doing the work load of more than their share. But, they are forced to do that in order to receive a good grade. Then the people who don't pull their weight are benefiting from the work of others.

I don't feel that it's fair that some people have to pick up the slack and do more than their fair share of the work, but don't get compensated for it in that they don't get extra points ... only the guarantee of the good grade for the project etc. The group project grade is usually a big part of the student's final grade in the course and therefore if the group

project grade is bad simply because all of the team members didn't do their part, then it can affect the final grade in a negative manner for the team members who did do their part, but relied on their team mates to pull their weight equally. This is not fair in my opinion.

I think that it is very difficult to have a virtual group because you have team members that don't participate and expect the other team members to carry their work load for them.

I still find it difficult to work with virtual teams due to misunderstanding and untimely postings. The only reason I take online courses is for convenience. I would prefer lecture and group projects in person.

I want to say that overall the virtual teamwork is a great idea. My team worked very well together, we knew what needed to be done and did it. However, there were a few members who did not perform in a timely fashion. This became a burden on the rest of the group when it came time to turning in the work. It became hard to rely on these members to be responsible for their efforts. In the end everything worked out and working in groups provides many benefits for those who do engage in the work.

There is no list of my team members and only one other person has posted in my teams discussion board, so I'm not sure if it's just me and her or if there are slackers on my team that haven't even looked at the discussion board yet.

Online classes with group projects in both and feel like I am doing the bulk of the work so my grade will not suffer. In my other class, in a group of six it is only two of us who actively participate. In this class you are researching on, my team members are habitually procrastinate that it is making my work difficult. With essentially one week left to go, I still cannot get any straight answers on the direction the project should go.

Leadership

Leadership also was highlighted as one of the factors affecting knowledge sharing in virtual teams. In this study, the instructors did not assign a team leader for virtual teams. Based on the students' reports, in some teams, One or more individuals emerged as team leader to take the responsibility to initiate the discussion, set a timeline for the project and submit the assignment for the team. This finding was consistent with the previous study: Pavitt (2003) had described the fact of emergent leadership as it happens through the interaction of the group; one or more individuals emerged to perform the leadership behaviors of emergent leaders in virtual

teams. However, there is not always a team leader within virtual teams. Some students also reported that there is not a team leader in their teams. Students' responses regarding team leaders are listed as following:

I've noticed there is sometimes more than one team leader. One team leader may give the team direction while the other is the one that puts all the ideas together. Also, the team leader does not always necessarily recognize outstanding performance.

We did not have a designated team leader. I have taken most of the initiative, but have not received a clear definition of who is our leader.

This debate was a closed discussion board so that only members of our team could use. I feel that I and another young lady stepped forward to set some rules and gives beginning ideas. I feel that a debate is really the only online team project that could work. There is only a debate at the end of class there is no paper that must be turned in so it makes it easier for everyone to participate.

There was no assigned team leader and it showed at first. I took the initiative to be the 'leader' and 'delegated' some tasks but it was easy because I had a great team to work with. Some students did the bare minimum as far as participation but others really stepped up to the plate and compensated for the others. All in all, it was not a bad experience, just a little stressful when your grade depends on someone else's work.

There were people that choose to step up to turn in the project/work and make sure everything is correct and we have all the information for that week, but it changed each week and the responsibilities were the same for whoever choose to turn it in. everyone just pitched in and did their part for most of the semester.

The group did not have a consistent leader every week. Each week a different member acted as team leader so that everyone had the chance to be in charge of the assignments that are due that week.

Cohesion

Team cohesion was defined by Mullen and Copper (1994) as the nature and quality of the emotional bonds of friendship such as liking, caring, and closeness among team members. Team cohesion played an essential role on teamwork. There were positive comments and negative ones from the students. The students who enjoyed their teamwork stated that their teammates took

their responsibilities, were willing to sharing knowledge, and could learn from their peers.

However, those students who did not like virtual teams complained that they felt isolated within in virtual teams since there were no responses or no timely responses from their peers. Some students condemned virtual teamwork as “nearly impossible due to time constraints and differing schedules.”

The following excerpts are representative examples of students’ comments regarding team cohesion. These postings include positive and negative comments on team cohesion. The positive comments exemplify that the high level of cohesion, or the high quality of the emotional bonds among team members was developed based on the students’ input or their contribution to the teamwork, their responsibilities for their tasks or the shared assignments. Whereas the negative comments regarding team cohesion were demonstrated by their disappointed experience within virtual teams, the feeling of lonely working in virtual teams, lack of timely feedback. All of these experiences hamper the team members’ cohesion to work together.

I really don’t like a virtual debate; I don’t feel connected with any of the members and I believe that it will be hard to come together in the end to have a successful debate. I would never recommend it or would never like to be part of one again.

I feel that the virtual teamwork is nearly impossible due to time constraints and differing schedules. It appears as team members do not post in a timely manner in order to propel the project forward. I do not recommend this format for learning/teaching.

I enjoyed working in a virtual team. Everyone on the team takes the accountability of finishing the assignment (case studies and group project) on time.

I think virtual team is cool. It help a lot especially when it comes to asking questions about assignment or other things that I or other student are confused about. I am surprised the amount of responses to the questions that other student or myself post on here. They are very helpful and I am glad to know that there are helpful people out there.

I enjoyed working online with my group. We found out the last few weeks of class that 4 of us lived in Jacksonville, FL. I believe that knowing that from the beginning of class

would have made a difference. In the future, location should be the first thing we ask about.

Using online media to complete the case studies and final project presented many challenges our group had to overcome. Since it is difficult to get all 5 members in the chat room function at one time, discussion boards and emails were the primary means of communication throughout the semester. This had its benefits and drawbacks, but our group was full of very capable, responsible students who all pitched in extra in order to get the job done.

Lack of participation

Another finding from the qualitative data is non active participation in some virtual teams. It has been suggested that student online interaction promotes student-centered learning, encourages student participation, and generates more in-depth discussions than traditional face to face courses discussion (Smith & Hardaker, 2000; Davies & Graff, 2005). However, findings from numerous studies have indicated that the student engagement in group discussion is often quite shallow, and rarely develops into a higher level of communication where negotiation, co-construction, and agreement occurred (Tallent-Runnels, Tomoas, Lan, Cooper, Ahern, Shaw, & Liu, 2006). The students' feedback related to lack of participation was listed as following;

I have not had any luck getting my team members to communicate at all on the topic. Although I have posted several discussion topics, I have only had one reply from one person asking to clarify the topic. I feel like I am working by myself.

I enjoy the idea of a debate and a discussion board but all in all it is difficult to get my team members to participate actively if at all. It is very frustrating because I feel that I am not totally prepared because my team mates have left limited responses to any concerns I might have.

I am finding that in this particular group there is not that much participation going on. I have done this kind of work before and I am finding it difficult to work with the people I am that aren't as experienced in this debate format, although I am being, understanding and willing to help.

My fellow team members did not communicate at all. They waited until the last minute to post anything. I had to post notices about five times before anyone responded. Out of the five assigned team members, I think three of us are still working in the team.

This online debate team thing sucks, I can only get in contact with one other member and it seems as though we're the only ones interested in completing the assignment. If this was a face-to-face class then maybe it would work, but this is very frustrating; especially since some of our team members live nowhere near campus!

Summary

The chapter presented the statistical findings of this study. First, a set of multiple regressions were conducted to examine the direct and indirect relationships among knowledge sharing and the identified five factors. The findings of this analysis indicated a statistically significant relationship among all variables in the path model (See Figure 4). All of the direct and indirect effects and relationships were statistically significant and the causal relationship is represented in the diagram. Specifically, mutual influence had a significant path relationship with knowledge sharing ($\beta = .55$, $p < .05$). Trust had a significant path relationship with conflict ($\beta = .19$, $p < .05$) which had a relationship with knowledge sharing ($\beta = .24$, $p < .05$). In addition, leadership had a strong relationship with team cohesion ($\beta = .45$, $p < .05$) which then had a relationship with knowledge sharing ($\beta = .71$, $p < .05$).

The researcher also examined the relationship between quality of knowledge sharing and students' learning achievement as well as the quantity of knowledge sharing and the students' learning achievement. The regression results show that there is a statistically significant relationship between quantity of knowledge sharing and students' learning achievement, however, there is not a statistically significant relationship between quality of knowledge sharing and the students' learning achievement.

Qualitative data collected from the open-ended question provided further insights toward the implications of these findings and strengthened possible interpretations. These possible interpretations are discussed in the next chapter of this study.

CHAPTER FIVE

DISCUSSION, IMPLICATIONS AND CONCLUSIONS

Purpose of the Study

The purpose of this study was to examine and analyze the nature of the relationships among knowledge sharing and the five identified factors: trust, mutual influence, conflict, cohesion, and leadership. In addition, the researcher investigated the relationship between the quality and quantity of knowledge sharing and students' grades. In doing so, the study first determined the five factors affecting student's willingness to engage in knowledge sharing in virtual teams in an online learning environment. The researcher used multiple regression and path analysis to examine the direct and indirect effects among and between each of the above factors. The results of the statistical analyses presented in the previous chapter supported the proposed theoretical model of factors affecting knowledge sharing within virtual teams. Specifically, the theoretical model was well supported by the collected data.

In this chapter, the analyses and results related to each research question will be discussed and the implications will be presented. The section presented the results and discussions by the research questions:

Discussion

Research Question One

Are the five factors affecting knowledge sharing within virtual teams in the online learning environment as represented in the path model consistent with the data collected?

The multiple regressions used to analyze the linear combination of five predictors were significantly related to the dependent variable, knowledge sharing. The standardized regression was used to determine the independent contributions of each of these predictors. Cohesion and mutual influence appear to make the most significant direct contribution to knowledge sharing. Based on the multiple regression and path analysis, there are several significant causal relationships shown in the diagram. Mutual influence and cohesion had direct relationships with knowledge sharing; trust affects knowledge sharing which is mediated through conflict; also leadership affects knowledge sharing which is mediated through team cohesion. More specifically, mutual influence had a significant path relationship with knowledge sharing. Trust had a significant path relationship with conflict, which had a relationship with knowledge sharing. In addition, leadership had a strong relationship with team cohesion which then had a relationship with knowledge sharing.

Trust and Knowledge sharing

In this study, the definition of trust was adapted from Anderson and Narus (1990) as the degree to which that team member believed his/her partners work well with each other. First, based on the model proposed by Nelson and Coopriider (1996), mutual influence and trust had an impact on knowledge sharing. In this study, the researcher proposed that mutual influence had a direct relationship with knowledge sharing, and trust affected knowledge sharing mediated through conflict. It was found in this study that the level of trust developed through virtual teamwork influenced the task conflict which had arisen from the different ideas and divergences, this task conflict can affect the level of knowledge sharing. These findings are consistent with the findings of Lee and Choi (2003) who demonstrated that trust can enable conflict to be used

effectively by encouraging the exploration of differences, promoting greater sharing of knowledge, and more importantly, stimulating the creation of knowledge. These factors stem from learning lead to innovation. Furthermore, Tjosovld (1997) contends that interdependence can be strengthened and made more innovative and productive work when conflict is well managed. Therefore, when there is trust development among team members, it enables team members to construct well-managed conflict, which can facilitate greater knowledge sharing and increase the potential opportunities for knowledge creation through subsequent interaction. The following statements reveal several examples of trust in teamwork in this study:

- “Virtual teamwork is great because it builds trust between total strangers and allows people to work with others efficiently.”
- “All my team members were trustworthy and turned in their parts to assignments in a timely manner.”
- “I enjoyed it. Usually I hate group work, but this time around I found that my teammates were able to take on responsibility and that make it work.”

Some students mentioned that their team members were trustworthy. Even when there were different opinions and some animosity within the group, they pulled together to complete the assignments. They also made compromises until all agreed on the same thing.

These results suggested that successful virtual teamwork is dependent on the level of trust developed through individual team member’s interaction and collaboration. From the comments of the students, two implications can be extracted from their attitudes toward trust development within virtual teams. First, credibility is necessary; so that members of those teams believe that their team members have capabilities and competence to make contributions within virtual teams because of their prior performance met expectations, therefore, they can trust each other. Second,

trust can be maintained by actions that are highly dynamic, proactive, and enthusiastic behaviors. Team members believe in each others' good intentions to work collaboratively on their teamwork. The timely feedback from team members and the amount of responses to the questions that team members posted are the signals of their intentions and commitments on teamwork which can show how much they care about their team and how much effort they put into their teamwork. All of this active communication promotes the development of trust among team members. Therefore, trust is one major factor affecting students' attitude towards to their knowledge sharing experience within virtual teams.

Mutual influence and knowledge sharing

Mutual influence is the second factor directly affecting knowledge sharing within virtual teams. In this study, it was found that mutual influence among team members is beneficial for the knowledge sharing process, as well as students' learning skills. In addition, it improved the quality of the team project. The qualitative excerpts collected from the open-ended question also provided important insights regarding this relationship. For those students who were satisfied with their virtual teamwork, the comments included:

- “Enjoy the virtual teamwork.”
- “The experience has been truly great for me”
- “Our group was full of very capable, responsible students who all pitched in extra in order to get the job done.”
- “The team was very good in that everyone participated and provided timely feedback.”

- “Sometimes I forgot to even go on the course website to complete my work online, but working as a team to achieve a best grade in the class, which make me want to come in and discuss about my work.”
- “I love the thoughts of having groups because I learned different perspectives when solving problems.”

The students with strong capabilities and competence affected or shaped others’ work by providing different perspectives and problem solving ideas. In addition, those students with highly dynamic, proactive, and enthusiastic attitudes toward teamwork, provided timely feedback, and took responsibility to work on their part of the project. They also helped others with their work. These actions played a role model for those members who habitually procrastinated on teamwork and provided untimely postings. The highly involved students’ behaviors influenced other students, a finding that is consistent with literature. In this study, the definition of mutual influence was adapted from Anderson and Narus (1990) “as the degree of the ability of virtual team members affects the executing tasks of each other.” Specifically, team members’ constant presence in the discussion board added incentive for other students to continue participation in the discussion boards. In addition, the team members’ postings affected or shaped others’ work. In Walker’s (2003) study, he suggested that students benefit from receiving feedback and helping others who had technology problems within teamwork. This process increased the sense of the community.

Conflict and Knowledge Sharing

Conflict is another factor affecting knowledge sharing within virtual teams. The presence of the “free-rider” is a problem in virtual teams which can lead to conflict among team members. Being a “free-rider” is also known as social loafing, which occurs when one or more members of

a group do not do their share of the work on a team project. In this study, the results indicated that task conflict had a positive correlation with quality of knowledge sharing. However, students in the group who engaged in social loafing or acted as “free- rider” hindered the knowledge sharing process and even the teamwork. Task conflict was defined by Jehn, Northcraft, and Neale (1999) as a disagreement and divergence that occurs when team members possess different ideas, opinions, goals, or information about the task. Based on literature reviews, there are two types of conflict within virtual teams: social conflict and task conflict. Social conflict focuses on incompatibilities or disputes and provokes hostility, distrust, criticism, and other negative emotions (Jehn, 1994). Kerr and Bruun (1983) identified the “free-rider” in virtual teams.

The excerpts from the qualitative data suggested that conflict rising from the actions of those not participating in teamwork is the major complaint for those students that are not satisfied with their virtual teamwork experience. The following are sample excerpts from the students regarding social loafing or the presence of a “free rider”:

- “In a group of six it is only two of us who actively participate.”
- “In this class you are researching on, my team members are habitually procrastinate that it is making my work difficult.”
- “I don't feel that it's fair that some people have to pick up the slack and do more than their fair share of the work, but don't get compensated for it in that they don't get extra points ...”
- “I enjoy the idea of a debate and a discussion board but all in all it is difficult to get my team members to participate actively at all.”

- “Some students did the bare minimum as far as participation but others really stepped up to the plate and compensated for the others.”
- “It is very frustrating because I feel that I am not totally prepared because my team mates have left limited responses to any concerns I might have.”
- “Out of the five assigned team members, I think three of us are still working in the team.”
- “My fellow team members did not communicate at all. They waited until the last minute to post anything. I had to post notices about five times before anyone responded.”

From these complaints, we can see the social conflict mainly arose from lack of participation in online discussion, untimely postings, and the situations where some students not work on their share of the work and let others complete work for them to get the project done. In this study, the results indicated that task conflicts which stem from different perspectives and disagreements had positive relationships with knowledge sharing. However, social conflicts arising from the dispute or dislike among team members can hinder the knowledge sharing and the team performance.

Leadership and Knowledge Sharing

Leadership is another factor that influences knowledge sharing mediated through team cohesion. In this study, it was found that leadership has been connected to the development of team cohesion, which had a strong impact on knowledge sharing. A perceived leadership index score was calculated for each team member based on the survey responses. Participants were asked to indicate whether they acted as team leaders or team members in their team. The

participants were also given the option to indicate how their team leader performed based on the survey questions. The qualitative data analysis also reinforces the above findings. The following are sample comments from students regarding emergence of leadership:

- “I took the initiative to be the 'leader' and 'delegated' some tasks; it was easy because I had a great team to work with.”
- “My team never assigned a leader.”
- “The group did not have a consistent leader every week. Each week a different member acted as team leader so that everyone had the chance to be in charge of the assignments that are due that week.”
- “Each week a different member acted as team leader so that everyone had the chance to be in charge of the assignments that are due that week.”

Our findings indicated the emergence of three patterns regarding team leaders: 1) there is one person who emerged as the team leader; 2) there was no consensus as one single individual or individuals were identified by team members as a leader role; and 3) there was a different member who acted as team leader each week. Further, our statistical analysis results indicate that the relationship between leadership and cohesion was found to be of statistical significance; therefore cohesion had an impact on knowledge sharing.

The findings regarding the shared leadership are consistent with the study conducted by Pearce and Sims (1999). They proposed that leadership, especially shared leadership enables each member to lead at a certain part in the project based on that individual's strength. This flexible authority structure promoted the development of group interaction and socialization which in turn leads to group cohesion. In addition, Ensley, Pearson and Pearce (2003), confirmed that there is a relationship between shared leadership and the development of cohesion, and that

cohesion has impact on motivation and promote learners engage in social and task related teamwork. Evidence indicates that highly cohesive groups have a high degree of commitment to the group task (Klein & Mulvey, 1995).

Zigurs (2003) suggested that in real life virtual learning teams, the role of leadership may shift among team members. Each member may lead at certain points in the project based on their strengths. These shared leadership roles among team members provide a feeling of value and appreciation for each other.

A valuable finding within virtual teams in this study is self-emerged leadership, which means without instructor intervention, one or more person emerged as team leader within virtual teams. In this study, the leader's role had not been specifically designated and one or more students initially emerged to be a facilitator or team leader to encourage team members to actively engage in knowledge sharing. If more than one student emerged, then the leader roles rotated among team members.

Cohesion and Knowledge Sharing

Cohesion was defined by Mullen and Copper (1994) as "...the nature and quality of emotion bonds of friendship such as liking, caring, and closeness among team members." A number of studies have argued that team cohesion influences both social emotional and task related aspects in team process (Yoo, ALavi, 2001; Mullen and Copper 1994). The results of this study indicate that cohesion has a strong relationship with knowledge sharing. The findings revealed that students who achieved a high level of cohesion engaged in more knowledge sharing on online discussion boards within virtual teams than students achieving low levels of cohesion. From this study, it can be found that cohesion was a strong factor affecting knowledge sharing within virtual teams. This result supported the implication from studies conducted by Hogg

(1992) that suggested that cohesive group members exhibit more positive, personal, and favorable communication interactions. However, is the amount of interaction and discussion a factor in higher achievement? To answer this question, the study proposed two additional research questions.

The qualitative excerpts suggest that the cohesion, the nature and quality of emotional bonds of friendship is an important factor for students' active participation in discussion, which in turn affects knowledge sharing and team performance. For those teams that have a higher level of cohesion, team members enjoy the teamwork and work together; everyone fulfills their responsibilities to complete the assignment. The following statements revealed students' experience with team cohesion in virtual teams:

- "I enjoyed working in a virtual team. Everyone on the team takes the accountability of finishing the assignment"
- "I have not had any luck getting my team members to communicate at all on the topic. Although I have posted several discussion topics, I have only had one reply from one person asking to clarify the topic."
- "I feel like I am working by myself. I have not had this problem in the past."

All in all, students reported that in the teams with lower levels of cohesion, team members felt it was a difficult task to deal with virtual teamwork; there was very low level of participation in group discussion. Some students complained that: "I have not had any luck getting my team members to communicate at all on the topic. Although I have posted several discussion topics, I have only had one reply from one person asking to clarify the topic."

The first research question explored and examined the factors that affect student knowledge sharing through online discussion within virtual teams. Results suggested first that

mutual influence positively predicts knowledge sharing. Second, task conflict is a mediating variable between trust and knowledge sharing. The third finding is that leadership is a significant predictor of knowledge sharing mediated by team cohesion. The results indicate that mutual influence directly affects knowledge sharing. Also it appears that the level of trust developed through team interaction and collaboration affects the task conflict, which then affects the level of knowledge sharing. In addition, the team leader skills had an impact on team cohesion, which then affect the level of knowledge sharing.

Research Question Two

To what degree does the *quality* of knowledge sharing have an impact on students' grades within virtual teams?

The question examined whether the nature of the activity improves performance that is, does quality of group discussions or knowledge sharing lead to better grades. Quality of knowledge sharing was accessed and adapted from DeLone and McLean (2003). The scale accessed six attributes of shared knowledge: relevance, easy to understand, accuracy, completeness, reliable and timely. The question measured the relationship between the quality of knowledge sharing and the students' grades. The result of the multiple regression analysis indicated there is no statistical significance between these two variables. The findings for this question show that quality of knowledge sharing was not a predictor of students' grades.

Contrary to expectations, students who shared a high quality of knowledge in this study did not necessarily achieve higher grades. One possible explanation may be that the quality of knowledge sharing accessed by student self-reported measures is that all the items in the instrument require individuals to respond to questions about the level of knowledge sharing,

which could be biased. Students may not reflect the accuracy of the quality of knowledge sharing on the discussion board.

Another plausible explanation may be that the quality of online posting or knowledge sharing is just one of the aspects of grading; there are other grading criteria, such as the online quiz or online reflections. Another possible explanation is that there are specific criteria for the instructor giving the grade on online debate teams; quality of online postings is just one aspect of the criteria.

Research Question Three

To what degree does the *quantity* of knowledge sharing have an impact on students' grades within virtual teams?

The question concerns the relationship between the quantity of knowledge sharing and the students' learning achievement, specifically, the researcher examined whether the number of group discussions or amount of knowledge sharing leads to better grades. Quantity of knowledge sharing was determined by the number of postings that each student posted on discussion board. The result of a multiple regression analysis indicated quantity of knowledge sharing had a significant relationship with student's learning achievement.

It has been suggested that online interaction and group discussion promotes student-centered learning, encourages student participation, and produces more in-depth discussions than traditional face-to-face classes (Wu & Hiltz, 2004). Participation in group discussion or knowledge sharing provides two benefits: to improve learning and to provide support. Therefore, the frequency of the online interactions or the number of student online discussion postings is

more likely to provide support, whereas, quality of knowledge sharing may greatly affect learning and performance.

Overall, this study demonstrated the essential relationships among knowledge sharing and the five identified factors: mutual influence, trust, conflict, leadership and cohesion. Analysis for the path model indicated mutual influence and cohesion had direct relationships with knowledge sharing. Trust affects knowledge sharing mediated through the conflict; also leadership affects knowledge sharing mediated through team cohesion. In addition, the quantity of knowledge sharing had an impact on students' grades; however, quality of knowledge sharing did not have an impact on students' grades.

Significance of the Findings

The study examined two streams of knowledge sharing within virtual teams. First, it examined and analyzed the nature of the relationship among knowledge sharing and the five identified factors: trust, mutual influence, conflict, cohesion and leadership. The study used the path analysis to examine the direct and indirect effects among and between each of the above factors. Second, it investigated the relationship between quality and quantity of knowledge sharing with the student grade.

Results of this study confirm earlier studies that social interaction is a key element to maintaining a sound, well functioning and collaborative online community for student learning within virtual teams. This was indicated by Vygotsky's (1978) observation that social interaction is a condition for group learning. The sort of the process that allows the individual to learn collaboratively, understand and solve problems leads to the construction of knowledge. A major theoretical contribution of this study is the integration and interpretation of multiple studies by

Nelson and Coopriider (1996) and Wu, Lin and Lin (2006) to develop a model on factors affecting knowledge sharing within virtual teams. The model explains how these factors: mutual influence, trust, conflict, leadership and cohesion affect knowledge sharing within virtual teams at online learning environments.

The model in this study demonstrates the essential relationships among knowledge sharing and the five identified factors: mutual influence, trust, conflict, leadership and cohesion. Analysis for the path model indicates mutual influence and cohesion have direct relationship with knowledge sharing, trust affect knowledge sharing mediated through conflict; and leadership affects knowledge sharing mediated through team cohesion.

As far as the relationship between the quality and quantity of knowledge sharing with the students' grades, the study found that the students who self reported with higher quality of knowledge sharing not being achieved higher grades. However, students who interacted or participated more in online discussion board gained higher grades.

Limitations

The study was exploratory in nature and based on survey data. First, the survey data's validity may be threatened by the number of student who did not volunteer to answer the questionnaire. Second, the study used a convenience sample, thus the potential generalization of the study to other settings implementing virtual teams in higher education may be constrained. Future studies can be conducted to examine if similar results are obtained with another sample, or with other courses in other universities.

Another limitation for this study that must be considered is that all items in the online questionnaire were based on student self-reports. Constructs such as quality of knowledge

sharing, trust, mutual influence, conflict, team cohesion, and leadership, and how students view themselves and their assessment of their team interaction may not be accurate as they are the result of living the process; in other words, students' responses could be biased.

One more limitation is that this study does not include courses set up as mix-mode where online instruction is combined with traditional classroom meetings. Distance education has been predominant in recent years, and mix-mode and pure online style are the two major types of online courses. This study examined only pure online format courses. In the future, the research can be expanded to include both pure online and mix-mode courses.

Conclusion

The results of this study suggest that successful virtual teamwork is dependent on the nature of the student interaction. It appears that the higher level of trust developed through teamwork and online interaction affects task conflict, which then influences the level of knowledge sharing. In addition, the leadership had an impact on team cohesion, which then affected level of knowledge sharing. The results also suggest that the higher level of knowledge sharing occurs when trust, mutual influence, leadership, cohesion and task conflict exist.

In this study, another finding from qualitative responses is lack of participation in online discussion. One way to promote the team members to participate in teamwork is making the online discussion a part of the grade. This may encourage students to engage into online discussion. In order to help build trust and cohesion, the instructor may let student choose their own teammates, which might facilitate the development of trust and higher levels of interaction. Picciano (2002) suggested that design and facilitation should work together to ensure learner participation, which then impact on performance. This study examined and identified the factors

affecting knowledge sharing within virtual teams in online learning environments. Variables such as trust, mutual influence, cohesion, task conflict, and leadership should be studied in experimental settings within virtual teams through asynchronous discussion activities to generate a better sense of their effects on knowledge sharing and student learning. Continued research studies need to explore empirical support of best practices that will impact these variables, which in turn may positively impact knowledge sharing and student learning.

In addition, some of the team members complained about the unfairness of their grades since instructors normally give the score based on group effort. Instructors cannot assess the contributions of individual students. Normally, some of the team members may contribute more than other students. One way to evaluate individual's contribution is to utilize peer evaluation. Each individual grades all the team members and themselves. Future studies need to explore and examine appropriate assessment strategies which should incorporate evaluating the individual student contribution.

Implications and Future Research Recommendations

1. This study investigated the direct and indirect relationship among mutual influence, trust, task conflict, leadership, cohesion and knowledge sharing. Future research is needed to conduct on the design and development of sound learning environments for maximizing the condition of knowledge sharing within virtual teams. More specifically, how to design an online course that uses specific strategies to promote a high level of trust, effective mutual influence, appropriate leaderships, combined with a high level of cohesion. Such an environment will facilitate knowledge sharing within virtual teams in online learning environment.

2. This study conducted factors affecting knowledge sharing within virtual teams in two pure online courses, further investigation can be conducted to examine whether the present findings apply to other online courses such as mix-mode online courses.
3. This study found that leadership had a positive correlation with knowledge sharing and the emergence of a leader within virtual teams. Based on qualitative data analysis from students, the leader's role had not been specifically designated and one or more students initially emerged to act as facilitator to encourage team members to actively engage in knowledge sharing. If more than one student emerged, then the leader roles rotate among team members. Future research can examine whether a relationship exists between leadership and team performance. Do teams which have emerged team leaders performed better than those teams without team leaders?
4. This study already found that trust has a positive relationship with knowledge sharing which is mediated by task conflict. Future studies could examine what teaching strategies and instructional designs can facilitate the development of trust. Certain researchers suggested that trust can be facilitated by initial face to face interaction among virtual team members. In this study, although there is no requirement for face-to-face meeting during class time, some teams encouraged their team members to meet several times based on their own schedule. Future research can examine whether the initial face-to-face meeting or the following face-to-face meeting during teamwork can facilitate the development of trust among virtual teams.
5. The next recommended area of inquiry entails research on how to deal with the conflicts within virtual teams. In this study, the results indicated that task conflicts which stems from different perspectives and disagreements had a positive relationship with knowledge sharing. However, the social conflict that arises from the dispute or dislike among team members can hinder the knowledge sharing and the team performance. Future research is needed on the

guidelines or best practices on how to manage the conflict within virtual teams. In this area, we know very little about the real process of negotiations and the interventions when dealing with the conflict.

6. Another need for future research to address is how to assess the performance of knowledge sharing. In this study, some of the results indicated that quality of knowledge sharing was not a predictor of students' grades. In this study, the quality of knowledge sharing was measured by a survey of student self reported results. Students view of themselves and their assessment of their team interaction may not be accurate as the result of living the process. In future research, appropriate assessment strategies should be developed for evaluating the quality of online discussion. Subsequent research can combine more sophisticated techniques such as content analysis of the transcripts of the team interactions which can improve the accuracy of the assessment of performance of knowledge sharing as well as the overall team performance.

7. Lastly, the study examined the relationship between the quality and quantity of knowledge sharing in regards to the students' grades. The results indicated the students who self reported with higher quality of knowledge sharing not being achieved higher grades. However, students who interacted or participated more in online discussion board gained higher grades. We already realized that importance of the quality of interaction or team discussion, and it is possible that the quality of team discussion could impact students' learning achievements. Future studies can further examine the correlation between the qualities of team discussion and the students' learning achievements.

Summary

The study evaluated a path model of knowledge sharing within virtual teams specifying the relationships between mutual trust, mutual influence, conflict, team cohesion, team leader skills and knowledge sharing. In addition, the study examined the relationship between knowledge sharing and students' grades within virtual teams. The results show that mutual influence and cohesion had direct relationships with knowledge sharing, trust affects knowledge sharing mediated through the conflict; also leadership affects knowledge sharing mediated through team cohesion. At a more detailed level, cohesion appears to be the most strong factor affecting knowledge sharing among these five factors, followed by mutual influence; the task conflict affects knowledge sharing positively; the team leader affects knowledge sharing mediated by cohesion. In addition, quantity of knowledge sharing or the number of student's online postings had an impact on students' grades; however, the quality of the knowledge sharing did not have an impact on students' grades.

One of the relationships was between conflict and knowledge sharing. The results of this study support previous research that task conflict has a positive impact on knowledge sharing. The reasons for this finding are probably rooted in the nature of the projects. In addition, there are three patterns of leadership trends emerged within virtual teams in online education. The three patterns of leadership include: 1) there is one person emerged as the team leader; 2) there was no consensus as one single individual or individuals were identified by team members as team leader; 3) there is a different member that acted as team leader each week. Further studies needed to be conducted to elucidate these findings.

APPENDIX A: IRB APPROVAL LETTER



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Initial Review and Approval

From : UCF Institutional Review Board
FWA00000351, Exp. 10/8/11, IRB00001138

To : Jinxia He

Date : November 20, 2008

IRB Number: SBE-08-05907

Study Title: Examining factors that affect knowledge Sharing in virtual teams

Dear Researcher:

Your research protocol noted above was approved by **expedited** review by the UCF IRB Vice-chair on 11/20/2008. **The expiration date is 11/19/2009.** Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The category for which this study qualifies as expeditable research is as follows:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

A **waiver of documentation of consent** has been approved for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet, or statement of voluntary consent at the top of the survey.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <http://iris.research.ucf.edu>.

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 11/20/2008 10:48:29 AM EST

IRB Coordinator

APPENDIX B: CONSENT FORM



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

Department of Educational Research, Technology and Leadership
Instructional Technology/Media Program

Title of the Study:

Examining Factors That Affect Knowledge Sharing in Virtual Teams

Principal Investigator: Jinxia He

Dear Student,

My name is Jinxia He and I am a doctoral candidate at College of Education of University of Central Florida. I am seeking your participation in my dissertation study. **The purpose of my study** is to investigate the factors that affect knowledge sharing within virtual teams. I am contacting you because you have been working within a virtual team for at least one semester. Consequently, you offer a unique, informed perspective. This research study was designed solely for the purpose of research on the interactions that occur during virtual teaming. No one except me will be able to assess to your responses. You must be 18 years of age or older to participate.

Procedure:

Participation in this research requires the completion of an online survey that will take approximately 10-12 minutes. This online survey will be administered from November 19, 2008 to December 7, 2008. Your participation in this study is voluntary and participation will not affect your grade. You do not have to answer any questions that you do not wish to answer. Your identity will be kept confidential. All analyses will be done in a manner with no identification of any individual except for asking for your NID to give you extra points if you complete the survey. Participants who are willing to participate will be forwarded to another web-page where they will find a demographic form and a questionnaire for knowledge sharing within virtual teams. Upon completion of the surveys, participants will be asked to click on a "complete" icon which will terminate the survey and forward participant responses to a secured database (Form Manager). All responses will be encrypted, thereby I am the only researcher that will be able to retrieve the data. After the researcher communicates with the instructor to give you extra points, all research data that includes any individual participant's NIDS will be destroyed. Upon completion of the data collection period, (four weeks) all data on the Form Manager website will be permanently destroyed.

Voluntary participation:

Your participation is voluntary and completion of the data collection instruments is completely up to you. Participants should take part in this study only because they want to and can withdraw at any time.

Risks:

There is a slight of risk of loss of confidentiality if your information or your identities are obtained by someone other than the investigators, but precautions will be taken to prevent this from happening.

Benefits:

You will not directly benefit from this research other than increasing your knowledge about the research process. The survey explores topics potentially linked with virtual team effectiveness; the results may provide valuable information to virtual team members like you.

Compensation or payment:

Participants who complete the study will be given extra points by their course instructor. In order to receive the extra points, you will need to indicate your NID on the top of the online survey form so it can be separated from the study data once submitted. Your anonymity will still be respected by the researcher and all participant information (NID's) will be destroyed by the researcher upon communication with the course instructor. For those who select not to participate, you can work on an alternative assignment which has been approved by your instructor. The alternative assignment includes writing two paragraphs of reflection on your debate experience within virtual teams.



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

Confidentiality:

All participant information will be encrypted and stored in a secured database. This information will be used for statistical analysis. The information obtained from this research study may be used in future research and publications. However, your right to privacy will be retained. Surveys retrieved from each participant will be numerically coded for data analysis. Your name will not be written on any of the questionnaires.

Study contact for questions about the study or to report a problem:

If you have any questions or problems completing the survey, please contact me at (jhe@mail.ucf.edu, 423-741-2958) or either of my supervisors, Dr. Stephen Sivo (ssivo@mail.ucf.edu, 407-823-4147) or Dr. Glenda A Gunter (ggunter@mail.ucf.edu, 407-823-3502).

IRB contact about your rights in the study or to report a complaint:

Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

How to return this consent form to the researcher:

Please follow directions on the web-page after completing the surveys. If you choose to print and mail your survey packet you may do so at the address provided on the web link. Please **do not** include your name or other identifiable information on the surveys or mailing envelop except your NID if you would like the extra points being offered by your course instructor.

I understand my rights as a research participant, and I understand what the study is about and how and why it is being done. By completing the data collection instruments, I consent to participate in this research study.

**APPENDIX C: QUESTIONNAIRE FOR KNOWLEDGE SHARING
WITHIN VIRTUAL TEAMS**



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

DEFINITION

Virtual teams: For the purpose of this study, a virtual team is defined as a group in which people work interdependently with a shared purpose and they rarely meet face-to-face to communicate with technology (such as telephone, chat room, instant messenger, online discussion board).

Knowledge Sharing: The processes evolve from existing knowledge exchange to new knowledge construction through students respond to inquires, participate in group discussion and decision making and distribute ideas through online discussion board.

Team leader: In virtual teams, normally, there is a person emerging as a team leader who will assign the roles, initiate the discussion, mediate the conflicts and remind the deadlines and assign each member's role to get the project done.

Please select a course you are from: (Please select one even if you are taking both)

- HSA 3222
 HSA 4184

NID: (this one is used to identify students to give them extra credits).

Instructions: Based on your individual information, please select a most proper answer to each question.

1. Which team are you in? please type your team name or team number?

2. Number of team members in your team, include yourself:

- 2
 3
 4
 5
 >=6

3. How many times have you taken online courses before?

- 0
 1-2
 3-4
 >4

4. Have you worked with this team before?

- Yes
 No

5. Before you joined this team, how many virtual teams have you worked with?

- 0
 1
 2
 >=3

6. On my team, I am a

- Team member
 Team leader

7. Is English your native language?

- Yes
 No



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

DEFINITION

8. Age:

- <=18
- 19-24
- 25-29
- >=30

9. Ethnic groups

- White
- African American
- Asian
- Pacific
- Hispanic

10. Gender

- Female
- Male

11. How many times have you met face-to-face to work on your teamwork?

- 0
- 1
- 2
- >=3

12. Please indicate the frequency with which you use the following tools for knowledge sharing with fellow team members.

	Daily	A few times a week	Once a week	Once a month	Never/ Not applicable
Personal telephone call	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Webcourses Discussion Board	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group telephone conference	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video Conference	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shared Databases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Others



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

DEFINITION

Instructions: 1) You will be asked to respond based on your experience about the knowledge sharing within virtual teams on the Webcourses Discussion board. 2) Please circle one answer for each statement below.

Ratings:

- 5 Strongly Agree
 4 Agree
 3 Neither Agree nor Disagree
 2 Disagree
 1 Strongly Disagree
 0 Not Applicable

	5	4	3	2	1	0
Questions 13- 18 ask about the quality of knowledge sharing in virtual teams.						
13. The knowledge shared by team members in the discussion board is relevant to the topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. The knowledge shared by team members in the discussion board is easy to understand.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. The knowledge shared by team members in the discussion board is accurate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. The knowledge shared by team members in the discussion board is complete.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. The knowledge shared by team members in the discussion board is reliable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. The knowledge shared by team members in the discussion board is timely.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Questions 19- 24 ask about the personal outcome expectations for knowledge sharing.						
19. Sharing my knowledge will help me make friends with other members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Sharing my knowledge will give me a feeling of happiness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Sharing my knowledge can build up my reputation in my team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Sharing my knowledge will strengthen the ties between other members in my team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Sharing my knowledge will enable me to gain better cooperation with other members in my team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Sharing knowledge within teams can expand interpersonal relationships.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Questions 25-28 ask about trust within your team.						
25. Overall, the people in my team are very trustworthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. We are usually considerate of one another's feelings on this team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. The people in my team are friendly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. I can rely on those with whom I work in my team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Questions 29 -30 ask about the peer influence on knowledge sharing within your team.						
29. In general, other team member's constant presence in the discussion forums added incentive for me to continue participation in the discussion.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. In general, other team members' discussion postings affected or shaped my own work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Questionnaire for knowledge Sharing within Virtual Teams

Jinxia He

DEFINITION

Questions 31-34 ask about conflict within your virtual team.

31. My team members express different opinions about what we must do on the teamwork.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. My team members express different opinions about the goal of the teamwork.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. My team members express different opinions about the project related tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. My team members express different opinions about the actual work needed to complete the project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Questions 35-38 ask about team cohesion within your team.

35. My team members are united in trying to reach the goal for performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. My team members try to help if one of the members has problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37. My team communicates freely about each other's responsibility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38. My team leader treated team members with respect and dignity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Questions 39-47 ask about leadership within your team.

39. My team leader communicated all necessary information about the discussion topics in an effective manner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
40. My team leader encouraged team members to offer differing points of view on how they feel the team should function.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41. My team leader helped the team get the resources required so that we can meet the needs of the course requirement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
42. My team leader understood team member's needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43. My team leader helped promote self-motivation among team members.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
44. My team leader communicated work objectives and other directions clear and obtainable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
45. My team leader recognized and rewarded outstanding performance and extraordinary efforts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
46. My team leader promoted open and honest communication between team members.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47. My team leader provided useful feedback to members about their performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

48. Finally, the space below is for your use if you would like to share more experience with virtual teamwork.

End of survey. Thank you for your participation in this survey.

Submit

APPENDIX D: COPY OF E-MAIL THAT WERE SENT TO STUDENT TO INVITATE THAM TO PARTICIPATE IN THIS STUDY

Dear student:

My name is Jinxia He and I am a doctoral candidate at College of Education of University of Central Florida. I am seeking your participation in my dissertation study. The purpose of my study is to investigate the factors that affect knowledge sharing within virtual team. I am contacting you because you have been working on a virtual team at least one semester. Consequently, you offer a unique, informed perspective. This research study was designed solely for research purpose. No one except me can assess to your responses. I would greatly appreciate it if you would take a few minutes to complete my online survey.

Participation in this research requires completion of an approximately 10-12 minute online survey. This online survey will be administered from the November 20, 2008 to December 7, 2008. Your participation in this study is voluntary and participation will not affect your grade. You do not have to answer any question that you do not wish to answer. Your identity will be kept confidential. All analyses will be done in a manner with no identification of any individual. **However, extra 10 points will be added to your grade if you complete the questionnaire.** Clicking on the link below, you agree to voluntarily participate in this study. Otherwise, close the window if you do not want to take the survey.

<http://pegasus.cc.ucf.edu/~mpang/surveys/ConsentForm.html>

Please note that this study has been approved by UCF's Institutional Review Board (IRB). The informed consent form is attached on the web-link for more information on the IRB. If you need further information about this study, you may contact me at (jhe@mail.ucf.edu, 423-741-2958) or either of my supervisors, Dr. Stephen Sivo (ssivo@mail.ucf.edu, 407-823-4147) or Dr. Glenda A Gunter (ggunter@mail.ucf.edu, 407-823-3502).

Thank you for your time!
Sincerely
Jinxia He
University of Central Florida

APPENDIX E: EXPLORATORY FACTOR ANALYSIS RESULTS

Table 19: Structure Matrix for Six Factors of Knowledge Sharing

	Factor					
	1	2	3	4	5	6
LE44	.979	.423	.335	.219	.286	.173
LE43	.976	.435	.354	.208	.287	.194
LE46	.972	.398	.376	.224	.276	
LE42	.967	.433	.357	.163	.261	.133
LE39	.959	.436	.385	.219	.326	.110
LE47	.947	.399	.386	.206	.266	.219
LE40	.922	.386	.344	.204	.265	
LE41	.897	.382	.354	.191	.260	.125
LE45	.823	.335	.309	.193	.183	.121
LE38	.674	.499	.379	.160	.402	.293
CO35	.394	.883	.513	.221	.511	.403
CO36	.323	.873	.501	.249	.627	.455
CO37	.459	.868	.517	.195	.589	.352
TR28	.377	.851	.461	.133	.514	.605
TR25	.407	.798	.570	.166	.487	.572
KS18	.345	.765	.468	.198	.533	.186
IN29	.262	.628	.462	.186	.448	.348
IN30	.208	.496	.291	.299	.426	.378
PE22	.345	.500	.840	.273	.368	.275
PE23	.321	.659	.831	.261	.526	.444
PE20	.294	.441	.817	.219	.306	.265
PE21	.290	.519	.797	.253	.445	.389
PE19	.419	.443	.771	.369	.381	.287
PE24	.227	.429	.721	.268	.438	.304
CON33	.176	.189	.271	.967	.252	
CON34	.205	.193	.268	.901	.217	
CON32	.192	.187	.281	.881	.237	.142
CON31	.208	.396	.395	.794	.355	.166
KS14	.248	.591	.443	.234	.923	.392
KS13	.236	.603	.431	.189	.843	.414
KS15	.334	.644	.467	.287	.796	.326
KS16	.280	.718	.409	.250	.732	.282
KS17	.344	.663	.463	.334	.718	.329
TR27	.262	.660	.499	.156	.550	.898
TR26	.213	.673	.461	.244	.488	.753

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

Table 20: Factor Analysis on Total Variance Explained:

Total Variance Explained								Rotation
								Sums of Squared
								Loadings ^a
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Total	
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %		
1	14.595	41.701	41.701	12.199	34.853	34.853	10.713	
2	5.414	15.470	57.170	7.027	20.077	54.930	11.367	
3	3.087	8.819	65.989	3.131	8.947	63.877	8.761	
4	2.071	5.917	71.907	1.764	5.040	68.917	4.805	
5	1.328	3.795	75.702	1.032	2.949	71.866	8.108	
6	1.044	2.982	78.684	.778	2.222	74.088	4.477	
7	.946	2.703	81.386					
8	.576	1.646	83.032					
9	.542	1.550	84.581					
10	.506	1.444	86.026					
11	.458	1.309	87.334					
12	.444	1.269	88.603					
13	.387	1.107	89.710					
14	.368	1.050	90.760					
15	.343	.979	91.739					
16	.306	.875	92.614					
17	.298	.852	93.466					
18	.280	.799	94.264					
19	.249	.711	94.975					
20	.222	.634	95.609					
21	.203	.581	96.190					
22	.189	.541	96.731					
23	.187	.533	97.264					

24	.159	.454	97.718
25	.148	.424	98.142
26	.126	.359	98.501
27	.117	.335	98.836
28	.088	.252	99.088
29	.076	.216	99.304
30	.068	.195	99.499
31	.055	.158	99.657
32	.039	.112	99.769
33	.035	.101	99.870
34	.025	.071	99.941
35	.020	.059	100.000

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

APPENDIX F: CORRELATION MATRIX

Multiple Regression Result (Correlation Matrix)

		Correlations					
		QK	trust	influence	conflict	cohesion	leadership
Pearson Correlation	QK	1.000	.647	.548	.250	.722	.385
	trust	.647	1.000	.552	.163	.789	.355
	influence	.548	.552	1.000	.195	.491	.261
	conflict	.250	.163	.195	1.000	.221	.202
	cohesion	.722	.789	.491	.221	1.000	.412
	leadership	.385	.355	.261	.202	.412	1.000
Sig. (1-tailed)	QK	.	.000	.000	.002	.000	.000
	trust	.000	.	.000	.029	.000	.000
	influence	.000	.000	.	.011	.000	.001
	conflict	.002	.029	.011	.	.005	.009
	cohesion	.000	.000	.000	.005	.	.000
	leadership	.000	.000	.001	.009	.000	.
N	QK	136	136	136	136	136	136
	trust	136	136	136	136	136	136
	influence	136	136	136	136	136	136
	conflict	136	136	136	136	136	136
	cohesion	136	136	136	136	136	136
	leadership	136	136	136	136	136	136

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