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Factors Affecting Knowledge Sharing in Virtual Learning Teams (VLTs) in Distance Education

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ABSTRACT

This study asserts that knowledge sharing (a component of knowledge management) in distance education virtual learning teams (VLTs) is important for successful collaborative learning and that various factors characterizing person and environment can impact VLT members' knowledge sharing behavior. Factors under the category of *person* are VLT members' competencies for working on VLTs, and their learning goal orientation and performance goal orientation. Factors under *VLT environment* are social presence in the VLT, the VLT learning community, satisfaction with the VLT, task type, and instructor strategies. Knowledge sharing is defined as a behavior in which VLT members impart their expertise, insight, or understanding to other members in the VLT or to the entire team, intending for the recipients to have that knowledge in common with themselves, the sharers. The study used Bandura's (1986) model of triadic reciprocal causation as a theoretical framework. The model is suitable for this research because it considers relationships between person, environment, and behavior. First, the study identified variables that are directly related to knowledge sharing. Next, the study validated those constructs. After the constructs had been validated, they were entered into a knowledge sharing measurement model. The study empirically tested a measurement model with five latent variables, taking into account the measurement error. Next, the study cross-validated the model with multiple groups drawn from the same sample. The sample consisted of data from 1,374 participants matriculated in graduate and undergraduate programs at an online university. The data were analyzed using split sample methodology, multiple regression analysis, and structural equation modeling techniques (factor analysis and latent variable structural equation modeling-SEM). The study's findings suggest that there is a direct predictive relationship between

knowledge sharing and competencies for working on VLTs, learning environment, social presence, task type, and mediating relationships for learning community, social presence, and task type in the knowledge sharing model. This study contributes to research, theory, and practice. It concludes by presenting a knowledge sharing model that can be reevaluated with distance education student populations at various kinds of distance education institutions.

Key words: distance education, computer-supported collaborative learning, virtual learning teams, and knowledge sharing

FACTORS AFFECTING KNOWLEDGE SHARING IN VIRTUAL LEARNING TEAMS
(VLTs) IN DISTANCE EDUCATION

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

This chapter discusses the increased interest in distance education in recent years, the benefits of knowledge sharing, and the advantages and disadvantages of computer-mediated interaction for knowledge sharing in distance education. It states the problem addressed by this study and formulates the research question. Additionally, it presents the key concepts, discusses their relevance for the study, and highlights a number of other factors that may contribute to knowledge sharing. Further, the chapter states the purpose of the research and outlines the significance of the study. The chapter concludes with a summary.

Distance Education

In recent decades, a number of surveys conducted by the National Center for Education Statistics of the U.S. Department of Education have reported a constantly increasing quantity of educational institutions offering and intending to offer distance education in the coming years (NCES, 1997; 1999; 2003; 2009). According to Radford (2012), in 2007–08, about 4.3 million undergraduate students, or 20% of all undergraduates, took at least one distance education course. About 0.8 million, or 4%, of all undergraduates took their entire program through distance education. This increase in the number of learners participating in distance education is due to the ease and convenience that the Internet creates for communication.

PARTICIPATION
Percentage of undergraduates enrolled in a distance education course or degree program, by year: 1999–2000, 2003–04, and 2007–08

NOTE: In 2007–08 a distance education class was defined as a course taken for credit during the academic year that was not a correspondence course but was primarily delivered using live, interactive audio or videoconferencing, pre-recorded instructional videos, webcasts, CD-ROM or DVD, or computer-based systems delivered over the Internet. A distance education degree program was defined as a program taught entirely through distance education classes. Participation was defined similarly for 1999–2000 and 2003–04 undergraduates. (See complete descriptions of the distance education variables used in the Technical Notes.) Estimates include students enrolled in Title IV eligible postsecondary institutions in the 50 states, the District of Columbia, and Puerto Rico. Standard error tables are available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2012154.
SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999–2000, 2003–04, and 2007–08 National Postsecondary Student Aid Study (NPSAS:2000, NPSAS:04, and NPSAS:08).

Figure 1.1. Increase in distance education (1999–2009) (Adopted from: Radford 2012)

The Internet has the potential to create environments conducive to learning. Virtual classrooms can accommodate larger groups and can support discussions on complex issues (Hiltz & Turoff, 1993; Gallupe, Dennis, Cooper, Valachich, Bastinautti & Nunmaker, 1992). They can expose learners to a variety of ideas that will allow them to develop higher order thinking skills (Hoyles, Healy, & Pozzi, 1994). Anonymity via the Internet equalizes status (Hiltz & Turoff, 1993); it reduces stereotyping and/or mitigates any negative impact of cultural diversity on team

processes (Fichman–Shachaf, 2003). All of these factors can encourage socialization and participation.

In addition, communication in writing seems to be relatively immune to interruptions by controlling individuals (Gefen & Riding, 2005). Because electronic communication is somewhat more difficult and time consuming than oral communication, learners are less likely to engage in unproductive interactions (e.g., chatting) (Lam, Chua, & Williams, 2005). A low level of social pressure with written communication encourages responses that are better thought through, and that may therefore contribute to conflict management (Correia, 2008). The virtual environment can contribute to production quality by decreasing blockings and supporting the generation of unique, high quality, and nonredundant ideas in larger groups (Daily, Whatley, Ash, & Steiner, 1996; Daily & Steiner, 1998). Additionally, learners can participate in education from different locations (e.g., homes, workplace, Army, Navy) and at the hours convenient to them when the communication is asynchronous. Further students can engage in almost all the types of interactions (e.g., student-student, student-information, student-instructor, student-environment) that Reigeluth and Moore (1999) discuss within the framework that they suggest for comparing instructional models that can foster cognitive development.

Virtual Learning Teams

In this study, a *virtual learning team (VLT)* is defined as a "team where students meet only electronically, are geographically dispersed, and do not have the opportunity to meet the other members in person or participate in face-to-face meetings" (Barry, 2002, p. 73). *Virtuality* means that students interact in a virtual space supported by a course management system such as Blackboard, Angel, or an online learning management system specifically designed for an educational institution.

In recent years, working collaboratively with others has been a prominent focus in organizational research because of an increase in situations where people learn and work together. An advantage of using virtual teams is that they bring together individuals with needed competencies (knowledge, skills, attitudes, and abilities), regardless of their location (Blackburn, Furst, & Rosen, 2003). There is much potential for virtual team effectiveness. However, virtual teams do not always use their full potential, as evidenced by the fact that not all virtual teams succeed (Lipnack & Stamps, 1997).

In organizational research, virtual teams have been defined in terms of geography, temporal member distribution, adaptability, use of type of media, and member diversity. Most researchers seem to agree that the key feature of virtualness is the relative absence of face-to-face contact (Fiol & O'Connor, 2005). A number of studies have focused on the difference between face-to-face and virtual teams. For instance, Griffith, Sawyer, and Neale (2003) suggest that face-to-face and purely virtual teams are different in a nonlinear way even if the face-face-to-face teams meet only occasionally. Fiol and O'Connor (2005) went a step further. They compared face-to-face, hybrid, and purely virtual teams and concluded that both face-to-face and purely virtual teams differ in nonlinear ways from hybrid teams that meet occasionally. From their perspective, face-to-face teams are least uncertain, they have the most visibility, the greatest number of rich individuating cues (social cues), and the least diversity; they are also most influenced by politeness rituals. Hybrid teams with occasional face-to-face meetings have moderate level of uncertainty, a moderate level of visibility, intermittent individuating cues, a moderate degree of diversity, and intermittent influence by politeness rituals. Pure virtual teams, on the other hand, have the most uncertainty, the least visibility, the fewest rich individuating cues, the most diversity, and the fewest politeness rituals.

The Computer Supported Collaborative Learning (CSCL) paradigm brings together technology, psychology, philosophy, and pedagogy. Its focus is on "how collaborative learning supported by technology can enhance peer interaction and work in groups, and how collaboration and technology facilitate sharing and distributing of knowledge and expertise among community members" (Lipponen, 2002, p. 72). Distance education uses VLTs to bring student-centered instructional methodologies into virtual classrooms, and to create learning environments that foster development of interpersonal and collaborative skills in learners.

This interest in VLTs for distance education is aligned with the corporate world's interest in employees who possess not only a strong knowledge base, but also diversified social communication and cooperation skills, and the flexibility to work in different contexts and with others (McLaughlin & Luca, 2002). Additionally, employees' capabilities "to create, acquire, integrate and use knowledge" (Staples & Webster, 2008, p. 618) have been much in demand in recent years.

VLTs in distance education share characteristics with pure virtual teams because the chances for learners to meet face-to-face if the school or the program does not have residency requirements are slim. VLTs in distance education also share characteristics with learning teams whose main focus is on learning rather than on performance (although their performance is being used to assess their learning), and where members most likely expect that their learning team will support their learning.

Benefits of Knowledge Sharing

Biloslava and Trnavcecic (2007) discuss knowledge as "contextualized information, experience, perspectives, and insights that provide a framework from which to evaluate the events of the world and act upon them" (p. 276). They point out that individuals or groups

develop their capacity to act using knowledge obtained through formal learning as well as through hands-on experience and socialization. Actually, knowledge sharing (sometimes also labeled "knowledge transfer") is one of the processes in knowledge management, others being knowledge generation, storage, and usage.

Gunawardena, Jennings, Ortegano-Layne, Frechette, Carabajal, and Lindemann (2004) bring to our attention the fact that "knowledge is doubling every twenty-two months" (p. 41). They also point out the need for students to become lifelong learners who are aware of their own metacognitive processes so that they can cope with the overabundance of information that surrounds them. They further argue that learners would benefit from collaborative learning because it is dialogic and allows learners to engage in the social construction of knowledge because this type of learning allows learners to "constructively interact with the changing environment." This statement builds on the argument that Vygostky (1978) made about the socially constructed nature of learning that occurs in social and cultural contexts.

Viewing knowledge as socially constructed rather than as a possession of a single individual creates an emphasis on the distributed nature of knowledge. Thus, it has been argued that not only can groups and teams accomplish more than a single individual, but also learning in teams can lead to deeper understanding of both the content to be learned and the processes through which learning occurs (Rogers, 2000).

The corporate world acknowledges the importance of knowledge sharing. In 1999 *Financial Times* reported that the results of a survey of 260 CEOs and directors in European multinational organizations regarding their attitude towards knowledge sharing show that the majority of the respondents (94%) believe that knowledge sharing within organizations is an important behavior (cf. Bock & Kim, 2002). As Barnard (1938) points out, knowledge sharing is

an indication of organizational citizenship behavior, defined as "willingness of persons to contribute their individual efforts to the cooperative system" (p. 83). Knowledge sharing also contributes to the development of mental models and/or shared understanding which in turn can offer a number of specific advantages such as performance accuracy, efficiency, output quality, volume, timeliness, more efficient communication among team members, more accurate expectations and predictions, trust, high morale, collective efficacy, and satisfaction with the team (Cannon-Bowers & Salas, 2001). When team members develop a shared understanding of reality, further negotiations become unnecessary (Klimoski & Mohammed, 1994), questioning is minimized, and strategies are formulated to optimize team performance (Bolstad & Endsley, 1999) because for shared understanding it is necessary to collectively organize relevant knowledge (Hinds & Weisband, 2003).

According to Stout, Cannon-Bowers, Salas, and Milanovich (1999) task settings differ according to the level of threat they pose to human life. In some dynamic task settings (e.g., medicine and aviation) errors can result in the loss of human life, while in others inadequate knowledge sharing may result in a considerable waste of resources. Zhuge (2002) notes that knowledge management plays a key role in "upgrading the competitiveness of a team" because it is concerned with "innovating, spreading, sharing, and using of knowledge" (p. 23). Staples and Webster (2008) refer to knowledge as a "critical asset" and argue that knowledge sharing in teams improves team effectiveness (p. 618). Both physical and virtual teams bring together individuals from different backgrounds, with different expertise and different perspectives, who rely on one another's knowledge for solving problems (Powell, Piccoli, & Ives, 2004), and who will benefit from diversity (Staples & Webster, 2008) if they engage in knowledge sharing.

Springer, Stanne, and Donovan (1999) point out that individual cognition is developed in a social environment and that, when learners explain the material to others, they engage in cognitive elaboration, which contributes to learning. Choi, Land, and Turgeon (2005) suggest that the articulation of understanding, opinions, and perspectives allows learners to identify their cognitive conflict. The fact that they reflect on new knowledge, and justify and defend their positions allows them to coconstruct knowledge in a social context. In that process, learners reevaluate their thoughts and externalize their knowledge by transforming the internal processes into public processes. While doing so, they develop metacognitive knowledge that is (a) "knowledge of their cognition," (b) "knowledge about the specific cognitive demands of varied learning tasks," and (c) procedural knowledge of when and where to use acquired strategies" (p. 484). Dillenbourg, Baker, Blaye, and O'Malley (1996) point to the importance of active participation in activities, because it supports learners' "conceptual understanding" (p. 16) and the emergence of new metacognitive beliefs. Costa and O'Leary (1992) note that learners develop cocognition through collaborative learning. In other words, they cooperatively develop intellect, concepts, visions, and operational definitions of intelligent behavior, which guide them and help them reflect upon their own performance while in groups.

Problem Statement

The potential benefits of VLTs for collaboration make educators enthusiastic about using VLTs in instructional models. *Faculty Handbook* 2012 of the University of Phoenix Online lists some of the purposes for using learning teams in distance education: (a) "reinforce learning in the content area," (b) "serve as laboratories for learning how to become more effective as team members in the workplace, (c) help students improve interpersonal communication skills," (d) "enhance horizontal learning (the transfer of knowledge and information among students) of

discipline-specific course content through collaboration in the preparation of course assignments," (e) "facilitate collaboration that results in the development of higher-order thinking skills," (f) "serve as support groups to help students successfully negotiate the educational process," and (g) "provide experience in team or group activities that mirrors the workplace of the 21st century" (p. 22).

Though educators consider VLTs to be conducive to collaborative learning, students experience VLTs differently—partly because it accentuates their struggle to work productively with others. Learners' opinions about virtual learning teams as communicated in public forums tend to fall into one of three categories: (a) they do not see usefulness in virtual learning teams; (b) they accept that working in virtual learning teams can be challenging, but also understand their usefulness for their future workplaces, and (c) they appreciate the opportunity to work with others in virtual learning teams. Learners' reluctance to engage in teamwork has a negative impact on their technical competences and often leads to the development of undesirable behaviors (e.g., social loafing) (Drury, Kay, & Losberg, 2003; Waite, Jackson, Diwan & Leonardi, 2004). If they do participate in online discussions and collaborate with others, their achievement is promoted (Gunter, 2007).

Learners' dissatisfaction with VLTs stem from their underdeveloped collaboration skills and from learning environments created within VLTs that do not seem to meet their expectations of learning. A number of studies document employers' concerns about college students' deficiencies in three skill areas, one of which is teamwork (Casner-Lotto & Barrington, 2006; Dwyer, Millett, & Payne, 2006). Unproductive VLT processes can be invisible to instructors for a number of reasons. One is that learners are often preoccupied with team products rather than team processes and therefore do not mention any problems that they have with processes (Lam et

al., 2005). Moreover, instructors often assume that students already possess the "necessary skills to work effectively together" (Prichard, Stratford, & Bizo, 2006, p. 256), and therefore fail to help students amend team processes within VLTs in a timely manner. Both scenarios—failure by either the learners or the instructor—hamper development of the requisite team skills in students and subsequently result in dissatisfaction.

Five points should be noted when thinking about learning and knowledge sharing in VLTs. First, research suggests that using teams for learning does not guarantee that collaboration will happen (Brush, 1998; Johnson & Johnson, 1999). Dillenbourg (1999) points out that a collaborative situation is some kind of "social contract" that specifies "conditions under which some type of interactions may occur; [but] there is no guarantee that they will occur." Second, collaboration in itself does not lead to learning because individuals can also learn while they are alone. For learning to happen in groups, activities should be performed that "trigger specific learning mechanisms" (pp. 6–7). Third, although the ultimate goal of collaboration is to coconstruct knowledge, interaction does not always result in knowledge sharing (Fischer & Mandl, 2005; Jeong & Chi, 2007). Individuals might not always be willing to engage in knowledge sharing (Fisher & Fisher, 1998), and even employees may be reluctant to share their knowledge with others (Kelloway & Barling, 2000). Fourth, although the Internet is a "promising" tool for creating "powerful online learning communities" (Brown, 1999, p. 19), for knowledge sharing behavior to occur, team members must be willing to engage in behaviors that facilitate it (Rosen, Furst, & Blackburn, 2007). For example, knowledge sharing may fail to occur when individuals believe that their knowledge does not have value (Haldin-Herrgard, 2000), or when they may perceive it as highly valuable and be reluctant to share it with others, or only share it selectively (Leidner, 1999). Even in higher education, faculty members may

consider knowledge to be their private property (Wind & Main, 1999) and therefore a possible source of individual differentiation (Wiig, 1993). Fifth, VLT members' personal characteristics and VLT environmental factors might affect their knowledge sharing behavior. Thus, knowledge sharing may not always happen as expected, and this problem supports the rationale for studying factors that contribute to knowledge sharing behavior in VLTs in distance education.

Soller, Martinez, Jermann, and Muehlenbrock (2005) consider the complex nature of collaborative learning that results from the unpredictable interplay of a number of factors such as students' prior knowledge, motivation, roles, language, behavior, and group dynamics. Other factors can also affect VLT members' collaborative and knowledge sharing behavior. For instance, Yang (2007) emphasizes that there is a bidirectional relationship between competencies and knowledge sharing, stating that "knowledge sharing occurs when an individual is willing to assist as well as to learn from others in the development of new competencies" (p. 84). Wood and Bandura (1989) note that goals have a strong motivational effect—they can affect both the purpose and the direction of human behavior, as well as the amount of effort that individuals put forth. Interactive and interdependent tasks encourage mutual actions and exchange of ideas in learners (Samples, 1992). Computer-mediated instruction can create a feeling of social isolation (Shamp, 1991), which in turn might result in a reduced exchange of knowledge and information. Social presence can contribute to the creation of learner communities (Fabro & Garrison, 1998) that are more enthusiastic about engagement and interaction.

Individuals develop expectations from their environment (Bandura, 1999).Team members hold expectations that their team will be effective (Keyton, 1991) and that their team, as a learning community, will support their learning (Rovai, 2001). Male and female students might exhibit different knowledge sharing behavioral patterns due to gender differences (Belenky,

Clinchy, Goldberger, & Tarule, 1986). Knowledge sharing behaviors of students from different academic levels might differ, given the difference in the amount of experience that they have working with VLTs. Finally, instructors can also have a role relative to learning teams and their processes. Instructor strategies can create opportunities for scaffolding, which, as Ormrod (2004) notes, relates to the provision of structure and guidance that shape learners' behavior. This list is not exhaustive by any means.

Educators need to have sufficient information about the many factors contributing to VLT members' knowledge sharing behavior in distance education in order to be better able to design instructional environments that will encourage knowledge sharing in VLTs.

Research Question

The primary research question in the present study is, *Which factors contribute to knowledge sharing in virtual learning teams (VLTs)?*

Key Constructs

This study is interested in looking at the relationship of a number of key constructs such as knowledge sharing, competencies for working on VLTs, goal orientation, social presence in VLTs, learning community, satisfaction with VLT, task type, and instructor strategies. The rationale for focusing on these constructs is presented below.

Knowledge Sharing

Knowledge sharing is central to this research study because social interaction is at the core of the constructivist instructional models that operate within the paradigm of Computer Supported Collaborative Learning (Dillenbourg, 1999). Furthermore, research on knowledge management, of which knowledge sharing is a component, is scarce regarding virtual teams in an organizational context (Martins, Gilson, & Maynard, 2004), and virtual learning teams in an

educational context. Most of the identified articles were from the organizational rather than the educational context.

Connelly and Kelloway (2003, p. 294) distinguish between information sharing and knowledge sharing, noting that knowledge sharing contains an "element of reciprocity," whereas information sharing can be "unidirectional and unrequested." Additionally, they view knowledge sharing as "pro-social" behavior geared towards the "well-being and integrity of others." Ford (2004, pp. 21–23) defines knowledge sharing as a behavior "in which an individual imparts his or her expertise, insight, or understanding to another individual or generalized other . . . with the intention that the end recipient may, ideally, have that knowledge in common with the sharer." Thus, knowledge sharing involves an informer (individual, group, or organization) a recipient, and a communication channel. Ford (2004) also presents a number of operationalizations found in the organizational literature for the construct knowledge sharing: (a) "intention or willingness to share knowledge," (b) "what one should share," (c) "what one normally shared," and (d) "what one does actually share." These operationalizations suggest that knowledge sharing has been viewed both as intention and actual behavior. Lee (2001) views knowledge sharing as "activities of transferring or disseminating knowledge from one person, group or organization to another" (p. 324). Constant, Kiesler, and Sproull (1994) note that sharing depends on the form of information, that is, individuals can be more willing to share intangible information (e.g., expertise and advice) than tangible information (e.g., a computer program) because they can derive personal benefit from sharing the former.

The definition of knowledge sharing in this study is adopted from Ford (2004) and slightly adapted to fit the VLT context. Thus, knowledge sharing within a VLT is defined as a behavior in which VLT individual members impart their expertise, insight, or understanding to

other individual members in the VLT or to the entire team with the intention that the end recipient(s) may have that knowledge in common with the sharer. In the case of VLTs, all team members are both informers and recipients of knowledge because they share knowledge asynchronously in cyberspace, using written communication, and the primary communication channel is the computer unless supplementary media (e.g., phone or videoconferencing) are used.

Competencies for Working on VLTs

Competencies are included in this research because research on physical and virtual teams suggests that competencies could be indicators of employee's effective performance (Stevens & Campion, 1994; Hertel, Konradt & Voss, 2006). According to Martins et al. (2004), in organizational research, virtual team competencies have been discussed from a theoretical perspective as benefiting organizations in terms of quality, creativity, and customer satisfaction. The existing studies, though relatively small in number, suggest that technical expertise in a virtual team positively relates to a team's success, its ability to deal with technical uncertainty, and to trust among group members.

Competencies are bundles of knowledge, skills, attitudes, and abilities; they are "learnable behaviors" (Steven & Campion, 1999, p. 208). The extant literature uses multiple definitions for competencies, suggesting different numbers of components, and raising questions about whether traits, values, and so forth, should or should not be included in competency bundles (Parry, 1998, p. 60). This lack of uniformity of terminology in the literature is more pronounced when one compares terms used in studies that are conducted on different continents. For instance, in Australian universities, both generic and discipline-specific learning outcomes fall under the term "graduate attributes" (Dowling, 2006, p. 97), rather than competencies.

Competencies are relevant across programs and disciplines (e.g., public health, business management, instructional design, and engineering) and at different points of entry into postsecondary education (Paulson, 2001). Outside of formal education, human resources management systems rely on competencies for employee selection, as a framework for training and development, as a basis for appraisal, and as a guide for planning (Lucia & Lepsinger, 1999). More recently, portability of competencies (Bers, 2001) and the creation of competency-based career transcripts have received increased attention because stakeholders want access to more accurate information about future employees' capabilities (SCANS Commission, 1991).

Knowledge. Knowledge has been defined by many. In broad terms, knowledge is the "body of information applied directly to the performance of a given activity" (Doolley, Linden, Dooley, & Algaraja, 2004, p. 317.) There are not only multiple definitions, but also multiple types of knowledge, which are often classified into dichotomies such as structured versus less structured, explicit versus tacit, hard versus soft, know-what versus know-how (see Hildreth & Kimble, 2002 for more). Further, knowledge has been viewed as general, specific, and disciplinary (Evers, Rush, & Berdrow, 1998), or as declarative and procedural (Gagne, Wagner, Goles, & Keller, 2005). Explicit knowledge (know-what) has been captured and shared through various means ranging from cave drawings to digital information. From an instructional perspective, know-what has been the focus of knowledge-based and teacher-centered classrooms, that is, teaching that emphasizes memorization and reproduction of information in objectivist learning environments. In the VLT context, knowledge (know-what) refers to discipline-specific knowledge, task-work knowledge (strategies necessary for task completion), teamwork knowledge (what a team is, what team roles and responsibilities are, etc.), hard and soft technology knowledge, and knowledge of telecooperation (advantages, challenges, expectations).

Skills. Skills are defined as sets or sequence of behaviors related to performance or doing something (Klemp, 1979), which has to result in something observable (Boyatzis, 1982) and which suggests "dimensions of increasing ability" such as "expertise, mastery and excellence" (Attwell, 1990, p. 433). Skills are also labeled as know-how, which Brown and Duguid (1998, p. 91) refer to as "core competency," that is, a "particular ability to put know-what into practice." Blackburn et al. (2003) discuss the example of a basketball coach who recruits talented players by first identifying the skill sets required for each position. This example suggests that individuals need different types of skills to complete different types of tasks, which they may or may not have. And if they do not, then the entire team might suffer from this deficiency. This example also suggests that if skills and tasks match, the team may be effective. In the VLT context, skills relate to individuals' use of their different types of knowledge (e.g., task, team, technology) towards the effective functioning of the VLT.

Attitudes/abilities/traits. Attitudes influence choices of actions. Ajzen and Fishbein (1980) view attitudes as a function of an individual's beliefs that are linked to the individual's behavioral intention. Gagne, Briggs, and Wager (1992) view attitudes as "the degree to which [a] person tends" to do or not do something (p. 269). Martin and Reigeluth (1999) define attitudes as "positive, neutral, or negative responses to or evaluations about a referent, usually represented as position (pro or con) and intensity (strong or weak), for example, liking, oppression, willingness, appreciation; attitudes may or may not result in action" (p. 494). Smith and Regan (2005, pp. 260–263) argue against separation of "cognitive, affective and psychomotor domains" because "any cognitive or psychomotor objective has some affective component to it." From their perspective, attitudes consist of three components: "knowing how" (cognitive), "knowing why" (affective) and "behavioral component" (engaging in behavior). Additionally, they argue that

attitudes can be learned, and they discuss three components of attitude learning: cognitive ("knowing how"), behavioral ("need to engage in behavior"), and affective ('knowing why"), which relates to the "urge or desire" to engage in a behavior.

Gagne et al. (1992, pp. 107–108) refer to abilities as "stable characteristics of each human individual, persisting over a long period of time, and not readily changed by regimens of instruction or practice focused upon them." Abilities, similar to traits, reflect personality (e.g., introversion, self-sufficiency) and are persistent "over relatively long periods and not readily influenced by instruction aimed at changing them." In the VLT context, attitudes relate to the individual's beliefs about the task, the team processes, and team outcomes that impact both knowledge sharing behavior and the overall VLT effectiveness. Ability is the VLT members' capability, created by their knowledge, skills, and attitudes, to perform a task, duty, or role in a particular setting—in other words, to engage in successful collaboration. Traits relate to personal characteristics such as conscientiousness, loyalty, and so on.

As the discussion above suggests, some components of the competencies (knowledge, attitudes, skills) could be learned while others may be difficult to change (e.g., ability, traits). This means that some components have "instructional value" (Martin & Reigeluth, 1999, p. 493), though the instructional value of others may be debatable. The assumption here is that if the VLT members enter VLTs with low levels of VLT competencies, it will affect their performance on VLTs. Organizational research suggests that competencies have predictive value for identifying individuals who can be successful on physical and virtual teams. Stevens and Campion (1994) suggest that effectiveness in physical teams relates to task-work, self-management, conflict resolution, collaborative problem solving, and goal setting. Hertel et al. (2006) define virtual team competencies as "individual determinants of team performance" and

suggest that success in virtual teams—in addition to task-work competencies (e.g., loyalty, conscientiousness, integrity) and teamwork competencies (e.g., communication, cooperation)— also relates to telecooperation competencies (e.g., trust, learning motivation, self-efficacy) (p. 480). In this study, competencies for working on VLTs refer to the knowledge, skills, attitudes, and abilities that allow VLT individual members to engage successfully in knowledge sharing in VLTs.

Goal Orientation

Goal orientation is included in this research because, other than bringing their competencies to VLTs, VLT individual members bring their goal orientation, which also can play a role in their knowledge sharing behavior. Previous research suggests that two types of goals support individuals' motivation in education: (a) learning (mastery) goals and (b) performance goals (Ames, 1992). Individuals with a learning goal orientation seek to understand and/or to master something new to increase their competence (Dweck, 1986), and while doing so, they embrace challenges and effectively strive under difficult conditions, often treating failure as useful feedback (Elliott & Dweck, 1988). Individuals with a strong learning goal orientation "persist, escalate effort, engage in solution-oriented self-instruction, and report enjoying the challenge" (Brett & VandeWalle, 1999, p. 864). Individuals with a learning goal orientation believe that their competence can be improved (Steele-Johnson, Beauregard, Hoover, & Schmidt, 2000).

Performance goal orientation, on the other hand, relates to demonstrating competence (Ames, 1992; Dweck, 1986). Individuals with a performance goal orientation have stable beliefs regarding their ability to control their learning outcomes (Dweck & Leggert, 1988). Because their perceived level of ability affects their perceptions of control over outcomes when they

perform well in relation to others, they believe that they have a high level of ability and that the outcomes are controllable. However, when they perform relatively poorly, they believe that their ability is low and that they have little control over outcomes. Individuals with a performance goal orientation believe that their competence is unlikely to change (Steele-Johnson et al., 2000).

Social Presence

Social presence is included in this research because social presence in virtual classrooms contributes to the creation of learning environments. Social presence is "the ability of learners to project themselves socially and affectively into a community of inquiry" (Rourke, Anderson, Garrison, & Archer, 1999, p. 52), or stated differently, it is the extent to which a person is perceived as *real* in computer-mediated communication (Gunawardena & Zittle, 1997). Akyol, Garrison, and Ozden (2009) note that learners value social presence because it supports the sharing of ideas, expressing of views, and collaboration. One line of research focuses on whether communities of inquiry (CoI) theory applies to distance education. Rourke and Kanuka (2009, p. 24) note that CoI theory supports "deep and meaningful learning." Deep and mearningful learning occurs through "critical examination of new facts and the effort to make numerous connections with existing knowledge and structures." They juxtapose deep learning with "surface learning," that is, "the uncritical acceptance of new facts and ideas." They also note that the latter often occurs in distance education because "students are not engaged in the constituent processes" (p. 39) that are essential for deep and meaningful learning. Annand (2011) suggests that in order to achieve higher-order cognition, learners should engage in all three types of interaction—learner-teacher, learner-content, and learner-learner—and that "social presence does not impact cognitive presence in a meaningful way in higher-level online learning

environments." However, the present study is concerned with social presence as an environmental factor and with its relationship to VLT members' knowledge sharing behavior.

Learning Community

Learning is the overall goal of education and learners are assigned to VLTs to enhance their learning in a collaborative environment. The effectiveness and outcome attainment of teams, among other things, depend on "supporting one another as individual learners" (Johnson, Suryiya, Yoon, Berett, & La Fleur, 2002, p. 382). The same expectation individuals hold of a learning community. In other words, individuals working with VLTs expect to find themselves in a collaborative environment where they feel that their intrateam community supports their learning. Effective VLTs support the learning of their members. From the social constructivist perspective, individual learning occurs through socialization and social interaction (Vygotsky, 1978), that is, by negotiating ideas and constructing knowledge in interaction. At the group level, learning is "the combined result of group actions and discussions" (Lemyre, Pinsent, Johnson, & Boutette, 2010, p. 6). Jonassen, Strobel, and Lee (2006) note, "According to newer perspectives, learning is less a solitary act of individuals but rather is distributed among people, their tools and communication media, history and the artifacts they create. Knowledge exists not only in the heads of learners, but also in the conversations and social relations among collaborators" (p. 144). This means that knowledge is being coconstructed through interaction. This coconstruction is enhanced by "constructive conflict… [that] gives rise to mutually shared cognition, leading to higher team effectiveness" (Van den Bossche, Gijselaers, Segers, & Krischner, 2006, p. 502). Rogoff (1994) suggests that, during learning, transformation of participation occurs because individuals "transform roles and understanding in the activities in which they participate" (p. 204). However, lack of support from the learning community on a VLT can affect the

collaborative effort within the teams and can have an impact on individual students' knowledge sharing behavior.

Satisfaction With VLT

The presence or the absence of this support creates VLT members' satisfaction or dissatisfaction with their VLT and its processes. Satisfaction in teams belongs to the affective domain (Martins et al., 2004). In effective teams, team members are satisfied with their teamwork experiences (Drury et al., 2003). Students' satisfaction with their VLT experiences is important for a number of reasons. First, negative experience with teamwork can develop into a negative mental model of teamwork that subsequently serves as an antecedent for the student's next team experience, thereby creating an impediment not only for the students themselves, but also for the entire team. Second, based on empirical evidence that satisfaction with team experiences positively relates to both teamwork and product quality, it follows that dissatisfaction with previous team experiences may hurt VLT effectiveness in terms of process and product quality (Campion, Papper, & Medsker, 1996; Hoegl & Gemuenden, 2001).

Task Type

Task type is included in this study because the level of task interdependence controls the level of cooperation (Hollingshead, McGrath, & O'Connor, 1993). In other words, task type can also imply type of class participation. Because disciplines may use tasks with different levels of interdependence, it would be unrealistic to expect that learners will engage in active knowledge sharing if the tasks do not require collaboration.

Instructor Strategies

Instructor strategies are included in this research because instructors' presence, expressed through the strategies they use, can shape behaviors in virtual classrooms. Instructors can play a

role in creating learning environment in VLTs. They can assist students' learning, team formation, and planning processes (Koh, Babour & Hill, 2010); they can monitor learning team processes and assist teams when help is requested (University of Phoenix *Faculty Handbook*, 2012). Instructors can also get involved with learning teams to some extent and evaluate group processes (Koh, Barbour, & Hill, 2010).

<div align="center">**Other Contributing Factors**</div>

This study also takes into consideration some demographic and general factors such as gender, ethnicity, age groups, academic culture (graduate level and undergraduate level) and areas of study.

Gender

It is important to consider gender for at least two reasons. First, the number of females joining distance education is increasing due to the increase in numbers of women entering the workplace (Buhler, 1997). Second, women today find employment in job categories previously held by men (Jackson, 1992). Psychological theories have identified differences between males and females by studying cognitive differences (e.g., Hyde, 1981), and feminist psychodynamic theories (e.g., Chodorow, 1978; Eichenbaum & Orbach, 1983; Miller, 1976) have contributed to further understanding of male-female differences and their various origins, and related the male-female differences to the "core self-structure" (Hare-Mustin & Marecek, 1988, p. 456).

Research has identified significant differences in the use of all knowledge management system components by males and females (males use more than females) (Taylor, 2004). Females have been found to prefer face-to-face interactions more than males do (e.g. Hodgson & Watson, 1987; Powell & Johnson, 1995). Research shows that women are more interdependent than men due to the gender socialization that they received at earlier stages of their lives (e.g.,

Dunn, Bremerton, & Munn, 1987). Additionally, females seem to be more altruistic than males (Organ, 1988). Their altruism is related to their understanding of the needs of others (Kidder, 2002). Although research does not assert that males are completely independent—the need to belong is characteristic of both genders—it suggests that both genders might fulfill their interdependence needs differently (Gabriel & Gardner, 1999). Findings also suggest that males and females require different levels of positive social interaction before they perceive the knowledge sharing culture as positive (Connelly & Kelloway, 2003). Men are less apprehensive about computer usage than women are (e.g., Gilroy & Desai, 1986). Males and females differ on their perceptions about the usefulness and ease of use of e-mail messages (Gefen & Straub, 1997). Gender has a significant effect on the use of knowledge management systems (Gold, Malhotra & Segars, 2001). Further, a slightly higher percentage of women (97.3%) than men (94.2%) have been found to share knowledge to help others do their jobs (Fraser, Marcella, and Middleton, 2000).

Ethnicity

Ethnicity is included in this study because inequalities in technology use by student subgroups seem to reflect broader sociocultural strata in society. Junco, Merson, and Salter (2010) conceptualize these inequalities along two dimensions: (a) "a digital divide in access to use of technology," and (b) "digital inequalities in how technologies are used" (p. 620). They support the perception that digital inequalities relate to social divide in the society, and ethnicity can relate to the extent to which computers and the Internet are used. From their perspective the reasons for this unequal use of technology partially relates to the disproportionate availability of resources at home and at school, and partially to the cultural and social influences in different ethnic groups that can encourage or discourage the use of technology.

Age Groups

Age groups were included in the study because of differences between younger and older generations' use of technology. Jones, Ramanau, Cross, and Healing (2010, p. 722) argue that young people (born after the 1980s) "have a natural aptitude and high skill levels when using new technologies" because they were born after the emergence of digital technologies and have grown up with computers and the Internet. On the other hand, older people seem to be "at least one step behind and unable to reach the kinds of natural fluency that comes with having grown up with new digital technologies." The difference in the levels of familiarity with technology also relates to the approaches in the two groups towards learning in computer-supported collaborative learning instructional models.

Academic Level

Academic level is included in this study because it relates to VLT members' amount of previous experience with VLTs (expressed in the number of VLTs worked with), and based on this, to their behavior within the undergraduate and graduate cultures. Length of experience with VLTs, in turn, ties into expert-novice experiences (Tanaka, Curran, & Sheinberg, 2005). Although distance education students may not immediately enroll into another course after one course is completed, the number of VLTs that they work in at undergraduate and/or graduate academic levels suggests the amount of their VLT experience. Differences in team experience can relate to team interactions in a number of favorable and unfavorable ways. A study conducted by Boehm and Egyed (1998) with software engineering students suggests that the level of team experience is negatively related to the level of effort that teams use towards their goal. In their study high- and medium-experience teams often needed only low effort, whereas low-experience teams tended to make the highest effort. Rentsch, Heffner and Duffy (1994)

suggest that "team members with different levels of experience may understand the process of teamwork very differently" (p. 450). Different levels of experience can on one hand lead to negotiations and scaffolding (Dornish & Land, 2002) and on the other hand to gaps in interaction because "higher experience team members conceptualize teamwork more concisely and in more abstract terms than [do] lower experience team members" (Rentsch et al., 1994, p. 450). Organizational research suggests that mental efficacy and physical efficacy at the team level benefit from initial experience, and that both mental and physical efficacy facilitate internal social cohesion on teams (Hirshfeld & Bernerth 2008). The levels of team expertise/experience seems to positively relate to the levels of similarity of the *cognitive* structures (mental models) of individual team members (Rentsch et al., 1994), which is hypothesized to directly and indirectly impact team outcomes (Cohen & Bailey, 1997).

Area of Study

Area of study is included in this research because it is assumed that students in different majors receive offers to work on tasks that differ in the level of interdependence and in the requirement for collaboration.

Other than the concepts listed above, the study also gathered information on the following areas: (a) whether the participants of the study had prior experience of working with VLTs; (b) whether they had high or low technical skills; (c) whether they used only computer to access their VLT space or they also used alternative technologies (e.g. iPhone, iPad); (d) whether their access to VLT space was limited or unlimited; (e) the number of hours per week they spent on VLT interactions; (f) whether they accessed their VLT space from home or workplace or both; (g) the method of group assignment (self-selected vs. instructor assigned), This information was used to describe the sample.

Research Purpose

The purpose of this research is twofold. First, the aim is to develop and validate a VLT knowledge sharing model consisting of the variables that show statistically significant positive relationships with knowledge sharing. Second, the aim is to explore the direct, indirect, and total effects of the variables in the model. Additionally, the study seeks to determine whether the VLT knowledge sharing model yields the same structure when analyzed with multiple groups.

Significance of the Study

This study is significant because it is original. No previous study has explored the selected concepts and their relationships in the way that this study does. It focuses on grouping of individuals for purposes of learning in distance education, which is a timely topic. It also focuses on knowledge sharing in small groups in virtual environment which is also a timely topic. This study is also interesting because it uses both deductive and inductive approaches. On one hand, it uses a theoretical framework, arranges the constructs under the categories within that framework; on the other hand, through an inductive approach, it validates the constructs that could be combined in the VLT knowledge sharing model. It is also significant because it could have a positive impact in the field of instructional design. Once a model of knowledge sharing is identified and validated, it can be used to guide the design and development of instructional environments that are conducive to knowledge sharing in distance education VLTs.

Glossary of Terms

Below are the definition of the terms used in the study for understanding by the reader.

Competencies	**KSAs**	Knowledge, skills, attitudes and abilities that support effective
Instructor strategies	**INST**	Strategies geared towards supporting virtual learning teams

Knowledge sharing	**KSHARE**	Sharing knowledge on: (a) task and team knowledge, (b) task and communication skills, (c) attitudes towards teammates and task, (d) team dynamics and interaction, and (e) team resources and working environment
Learning community	**LRNCOM**	Intrateam community that supports individual learning
Learning goal orientation	**LG**	Students' readiness and willingness to learn new things despite the difficulties that they may face
Performance goal orientation	**PG**	Students' willingness to perform well and avoid errors
Satisfaction	**SAT**	Satisfaction/ dissatisfaction with team experiences
Social Presence	**SOPRE**	Extent to which individuals project themselves as real in virtual learning teams
Task type	**TTYPE**	Level of task interdependence

Summary

Recent decades have witnessed an increase in distance education, and some distance education models use virtual learning teams. It is important to take a closer look at them. Though the functioning of physical teams has been well researched, the functioning of virtual teams and virtual learning teams both in organizational settings and in distance education needs further examination. Knowledge sharing is a current topic in organizational literature. The corporate world seeks students capable of effectively interacting and sharing their knowledge with others, especially because many people are not enthusiastic about knowledge sharing. To better understand distance education students' knowledge sharing behavior, this study employs a model of knowledge sharing that makes possible a better understanding of the relationships between a number of constructs, namely, virtual learning team competencies, goal orientation (learning and performance), social presence, learning community, satisfaction with VLT and its processes, task

type, instructor strategies, and knowledge sharing. These constructs seem to directly and indirectly influence VLT members' knowledge sharing behavior. The rationale for including these constructs in the model has been provided. The next chapter summarizes the relevant literature and presents the theoretical framework for the research. Additionally, it provides conceptual and theoretical justifications for the research design.

CHAPTER 2: LITERATURE REVIEW
Introduction

This study is designed to answer the question, Which factors contribute to knowledge sharing in virtual learning teams (VLTs)? The previous chapter presented some historical information on distance education. It discussed the importance that workplaces ascribe to knowledge sharing. It stated the problem, presented the research question, and introduced the key concepts and other concepts that are included in the study. This chapter discusses some empirical research in the extant literature related to knowledge sharing and the theoretical frameworks that different studies used as their theoretical lens. Additionally, the chapter presents the theoretical framework for the present study and discusses the variables of interest within this framework, providing the dimensions along which the constructs in the study were measured.

Empirical Research on Knowledge Sharing

In recent years, a number of studies have focused on knowledge sharing, mostly in organizational research and typically using different theories. Some of these studies are highlighted here.

Several studies (Casimir, Ng, & Cheng, 2012; Constant, Kiesler, & Sproull, 1994; Chen, Chen, & Kinshuk, 2009; Ford, 2004; Wu, 2011) used the theory of reasoned action and/or its extension, the theory of planned behavior, to explore knowledge sharing. Jeon, Kim, and Koh (2011) used the theory of planned behavior in combination with the theory of motivation (intrinsic and extrinsic motivation) and the Triandis model (an extension of the theory of reasoned action) (Triandis, 1980). The theory of reasoned action maintains that human behavior is impacted by attitudes, subjective norms, and intentions. The motivation theory differentiates between intrinsic and extrinsic motivations, and the Triandis model argues that human behavior

is determined by the individual's intentions, which, in turn, are influenced by social factors, affect, and perceived consequences. Additionally, behavior is determined by the presence or absence of facilitating (or debilitating) conditions.

Constant et al. (1994) discuss three studies that looked at attitudes and subjective norms that support or restrain information sharing in advanced organizations. Among other findings, one of the studies suggests that people attach different meanings to intangible information (e.g., expertise) and to tangible information (e.g., a computer program) and might be more willing to share tangible information because intangible information might reveal their identity or inner qualities (e.g., they might seem to be showing off their expertise).

Ford (2004) conducted a study with 46 participants using mixed methods to identify the relationships between attitudes, subjective norms, intention to share, and actual knowledge sharing. The results of the study suggest that the theory of reasoned action does help to explain the actual knowledge sharing behavior, although approximately 86 to 87% of variance in actual knowledge sharing behavior did not seem to be predicted by intentions. Additionally, the results suggest that perceived behavioral control is not a significant predictor of intentions or of actual knowledge sharing. Ford (2004, p. 371) argues that "sharing occurs more out of necessity than out of intentions." She proposes six behavioral categories that capture the *how much* of knowledge sharing—in other words the amount of "effort [individuals] want to expend" (p. 187). These six categories are as follows:

1. "Active knowledge sharing." When individuals engage in this behavior, they fully share their knowledge with others and do not withhold any aspects of knowledge. They also exhibit mentoring behavior in that they follow up to ensure that understanding took place.

2. "Discretionary knowledge sharing." When individuals engage in this behavior, the level of knowledge sharing is high, but also there is moderate level of knowledge hoarding. Individuals will share their knowledge as much as possible, and their knowledge hoarding behavior can be related to constraints such as confidentiality, time and so on.

3. "Partial knowledge sharing or knowledge hiding." In this behavior both knowledge sharing and knowledge hoarding can be on the same level. Individuals may share some knowledge, but they will withhold some as well.

4. "Knowledge hinting." In this behavior individuals share their knowledge and while doing so, they bury their knowledge in other knowledge or information .

5. "Active knowledge hoarding." In this behavior knowledge hoarding is high and knowledge sharing is low. Individuals may withhold all of their knowledge from potential recipients.

6. "Disengaged." In this behavior both knowledge sharing and knowledge hoarding are low. In other words, individuals neither strive to share knowledge not to hoard it (pp. 184–185).

Chen et al. (2009) studied the relationships between social network times, learners' attitudes towards knowledge sharing, their web-specific self-efficacy (beliefs in their capabilities of performing online knowledge sharing), their subjective norms, and their actual knowledge sharing behavior, as well as whether the knowledge sharing behavior mediated these relationships. The participants in the study were 369 full-time senior college students and MBA students. The results of the study suggest that attitude, subjective norms, web-specific self-efficacy, and social network times are good predictors of knowledge sharing intention.

Knowledge sharing intention is significantly associated with knowledge sharing behavior, whereas knowledge creation self-efficacy has not been found to significantly impact knowledge sharing intention.

Wu (2011) studied the relationships between subjective norms, expected contributions, expected loss, distinctiveness, altruism, positive reinforcement, expected relationships, sharing interference, and knowledge sharing attitudes of 250 participants from four universities in Taiwan. The results of the study suggest that subjective norms, expected contributions, expected loss, distinctiveness, and altruism influence knowledge sharing attitudes; whereas positive reinforcement, expected relationships, and sharing interference have no significant influence.

Casimir et al. (2012) studied the relationship between intention to share and knowledge sharing using, information technology usage as a mediator/moderator variable. The participants in the study were 483 full-time employees from 23 organizations. The results of the study suggest that information technology usage mediates the relationship between intention to share and knowledge sharing behavior.

Majchrzak, Rice, Malhorta, King, and Ba (2000) conducted a case study using adaptive structuration theory (DeSanctis & Poole, 1994) to investigate technology adaptation in interorganizational virtual teams whose task was to create a highly innovative product over a ten-month period. The theory examines the change process from two vantage points: (a) the type of structures that are provided by advanced technologies, and (b) the structures that actually emerge as people interact with these technologies. A central aspect of the study was the question, What helps knowledge sharing (what is shared and what furthers sharing)? The results of the study suggest that, in situations when the virtual teams face discrepant events, they adaptively use technology for effective collaboration.

Sole and Edmondson (2002) used the situated knowledge perspective in a longitudinal qualitative study to explore processes of acquiring, sharing, and applying knowledge in teams with members from different locations and occupations—especially how virtual teams might overcome challenges created by functional boundaries and geographic dispersion in order to accomplish ambitious project goals. According to this perspective, knowledge is dispersed among team members, and teams benefit from the fact that dispersed teams can leverage local skills and resources. The findings of the research suggest that dispersed teams highly valued learning, but the ease of learning depended on differences in team members' awareness of relevant situated knowledge and how readily that knowledge could be appropriated.

Lichtenstein and Hunter (2004) conducted two exploratory case studies of knowledge sharing using receiver theory. This theory argues that it is the receiver's needs and behavior rather than the sharer's needs that drive the knowledge sharing process. The results of the study suggest that sharers tend to share knowledge when they believe that the receiver is ready.

Ardichvili, Maurer, Wentling, and Stuedermann (2006) conducted a qualitative study with 36 managers and employees in three countries—Brazil, China, and Russia—to explore the impact of cultural factors (degree of collectivism, competitiveness, importance of saving face, in-group orientation, attention paid to power and hierarchy, and culture-specific preferences for communication modes) on knowledge sharing in virtual communities of practice. The results of the study suggest that the above-listed factors have different levels of importance for knowledge sharing in different countries. For instance, saving face was found to be less important in China than expected, whereas modesty and competitiveness were found to be serious barriers to information sharing in China, but not in Russia and Brazil. Perceived differences in power and hierarchy were found to be less critical in all three countries than initially assumed.

Liao (2006) used the social power framework (French & Raven, 1959) to study the relationships between the power of teachers (e.g., reward, punishment, and legitimacy), interaction (learners' perceived degree of interaction with other learners), knowledge sharing, and learning satisfaction for 103 undergraduate students enrolled and studying in a distance learning course. The results of the study suggest that learning satisfaction has a direct relationship with knowledge sharing, whereas interactions do not have a significant relationship with learning satisfaction; and the teacher's reward power has a direct impact on interaction and knowledge sharing behavior though other powers do not.

Matzler, Renzl, Muller, Nerting, and Mooradian (2008) used the framework of Big Five personality dimensions to explore relationships between three personality traits (agreeableness, conscientiousness, and openness to experience) and knowledge sharing among 124 employees of an internationally operating engineering company. The results of the study suggest that agreeableness, conscientiousness, and openness influence knowledge sharing.

Zboralski (2009) used the social theory of learning (Lave & Wenger, 1991) to look at knowledge sharing in the context of communities of practice (CoPs) among 222 members of multinational companies. Lave and Wenger (1991) view communities of practice as active systems in which participants share understanding concerning "what they are doing and what that means" (p. 98). The study explored whether community members' motivation to participate in CoPs, the importance of the community leader, and management support affected knowledge sharing in CoPs. The results of the study suggest that support from the leading facilitator and management positively influence interaction processes in CoPs.

Paroutis and Al Saleh (2009) conducted a qualitative study using grounded theory to study the reasons for and barriers to knowledge sharing and collaboration among 11 employees

(5 users of Web 2.0 and 6 nonusers). The study identified four key determinants of knowledge sharing using Web 2.0 technologies: history, outcome expectations, perceived organizational or management support, and trust.

He (2009) used social interdependence theory (Johnson & Johnson, 1999), cognitive development theory (Piaget, 1965), and social constructivist theory (Jonassen, Davidson, Collins, Campbell, & Haag, 1995) to study the relationships between trust, mutual influence, conflict, leadership, cohesion, quality, and quantity of knowledge sharing and students' grades for 148 undergraduate students. Social interdependence theory argues that there must be a type of interaction in which individuals have each other determine the outcomes. Social cognitive theory emphasizes the importance of cognitive conflict for cognitive development. Social constructivist theory emphasizes the importance of collaboration for knowledge construction. The results of the study suggest that mutual influence and team cohesion are major factors affecting knowledge sharing. Conflict mediates the relationship between trust and knowledge sharing. Leadership has a strong relationship with team cohesion, which has a relationship with knowledge sharing. No significant relationship exists between quantity of knowledge sharing and student grades.

Ma and Yuen (2010) used the social interaction theory (Baumeister & Leary, 1995) to study the relationship between perceived online attachment motivation and perceived online relationship commitment to online knowledge sharing behavior for 581 undergraduate students. Baumeister and Leary (1995) note that social interaction is an innate human drive, and supports the "need to belong," that is, "a need to form and maintain at least a minimum quantity of interpersonal relationships" (p. 499). The results of the study suggest that the perceived online attachment motivation and perceived online relationship commitment together explain 71% of the variance observed in self-reported online knowledge sharing behavior.

Li (2010) used the united theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003) in a qualitative study with 21 American and 20 Chinese employees who worked for a multinational Fortune 100 company. The purpose of the study was to explore the relationships between organizational factors (performance, expectancy, compatibility based on work practice, knowledge sharing culture, and time pressure), and cultural factors (language, different thinking logic, and different level of perceived credibility for knowledge sharing) and online knowledge sharing. The theory maintains that performance expectancy, effort expectancy, social influence, and facilitating conditions influence use behavior in information systems. The results of the study suggest that performance expectancy, compatibility based on work practice, knowledge sharing culture, and time pressure strongly influence knowledge sharing for both Chinese and Americans. Language, different thinking logic, and different levels of perceived credibility to voluntarily share knowledge showed cultural differences (Chinese participants contributed knowledge less frequently than U.S. peers).

A number of studies (including Bock & Kim, 2002; Forstenlechner & Lettice, 2007) used social exchange theory (Blau, 1964) to study knowledge sharing. According to social exchange theory, social interaction originates the expectation that social rewards will follow (Wasko and Faraj (2005, p. 39).

Bock and Kim (2002) studied actual knowledge sharing among 467 employees from four large, public organizations. Additionally, the study explored the intention to share. The study concluded that social exchange (nonmonetary) can explain knowledge sharing because it suggests reciprocity of favors, meaning that if an individual receives something from another individual, that person will feel obligated to offer something in return. The results of the study also suggest that, although the intention to share knowledge is positively related to actual

knowledge sharing ($\beta = 0.118$, p<0.05), the explanatory power of intention on behavior is reported to be rather low ($r^2 = 0.014$). Ford (2004) notes that "intentions never perfectly predict actual behavior" (p. 42). However, an earlier study by Venkatesh and Davis (2000) found that intentions to adopt technology explained about 60% of variance in actual technology acceptance.

The study by Forstenlechner and Lettice (2007) explored the relationship between the means that motivate knowledge sharing (e.g., career prospects, authority, provision of charge codes, recognition among peers, and online incentives) and knowledge sharing and creation in more than one-fourth of the more than 2,500 lawyers in multinational law firms in more than 25 offices in over 15 countries. The results of the study suggest that the means that motivate knowledge sharing have diverse impacts around the world.

Jeon et al. (2011) studied the relationships between intrinsic and extrinsic motivation and knowledge sharing attitudes, intentions, and behaviors among 282 employees in large Korean high technology production companies. The results of the study suggest that both intrinsic and extrinsic motivation positively influence attitudes towards knowledge sharing behavior, but that intrinsic motivation is more influential. Differences in knowledge sharing mechanisms were noted between formally managed communities of practice and informally nurtured communities of practice.

Hong and Vai (2008) conducted a case study with various cross-functional virtual team members in a local subsidiary of a multinational telecommunication corporation and two of its hardware vendors. The results of the study suggest that team members employ the following four knowledge sharing mechanisms: shared understanding, learning climate, job rotation, and coaching. Among these four, shared understanding and learning climate are able to overcome the unwillingness of virtual team members to participate in the knowledge sharing process; whereas

coaching and job rotation compensate for the lack of collective competence required for performing the co-operative works.

Lin, Hung, and Chen (2009) used social cognitive theory (Bandura 1982, 1986, 1997) to study the relationships between contextual factors (e.g., norms of reciprocity, trust), knowledge sharing, and community loyalty for 350 members of three professional virtual communities. The study used knowledge sharing self-efficacy, perceived relative advantage, and perceived compatibility as mediating variables. According to social cognitive theory, there is reciprocal causation between person, environment, and behavior. The results of the study suggest that trust significantly influences knowledge sharing self-efficacy, perceived relative advantage, and perceived compatibility, which in turn positively affect knowledge sharing behavior. Norms of reciprocity do not significantly affect knowledge sharing behavior.

In sum, the extant literature on knowledge sharing in organizational and educational contexts highlights several predictor variables and uses a variety of theories. However, none of the studies used competencies for working on VLTs, goal orientation, task type, instructor strategies, social presence, expectation of learning, or satisfaction, all of which are variables of interest in the present study, particularly insofar as they can be predictors of knowledge sharing in VLTs. Based on the aforementioned literature review and the variables just mentioned, social cognitive theory (Bandura, 1982, 1986, 1997) appears to be the most appropriate theoretical lens, because the present study centers on the identification of relationships between *person* (competencies, goal orientation), *environment* (task type, instructor strategies, social presence, expectation of learning, and satisfaction) and *behavior* (knowledge sharing). Therefore, this study used Bandura's (1986) model of triadic reciprocal causation as its theoretical lens.

Theoretical Framework and Hypotheses

Model of Triadic Reciprocal Causation

The contribution of the triadic reciprocal causation model is that it created a shift away from "unidirectional causation," that is, human behavior viewed as "shaped and controlled either by environmental influences or by internal dispositions" (Bandura, 1986, p. 2). Instead, Bandura's model suggests a bidirectional relationship between person, environment, and behavior. Though personal factors (cognitive, affective, biological), behavioral patterns, and environmental events interact bidirectionally, influences between them do not have equal strength and do not happen simultaneously (Bandura, 1999). The model of triadic reciprocal causation is at the core of social cognitive theory. It is used as a theoretical framework in research studies conducted in different contexts (e.g., education institutions and corporations).
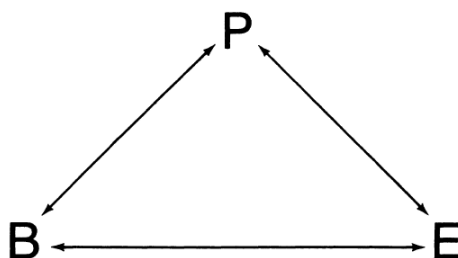
Figure 2.1. Model of triadic reciprocal causation (Bandura, 1986, p. 24) (P=person; B=behavior; E= environment)

The model has been used to study health behavior in public health studies (e.g., Shannon & Parker, 2012). For instance, Heuze, Raimbault, and Fontayne (2006) used the model to look at the relationships between cohesion, collective efficacy, and performance in professional basketball teams. Henson (2001) used the model to look at teacher efficacy in teacher education, while Parker (2006) used it to analyze practice learning in social work, and Tha (2010) used it to

examine knowledge sharing in an electronic knowledge repository. Wu, Tennyson, and Hsia (2010) used the model to study student satisfaction in a blended e-learning system environment.

Wu et al. (2010) explain the popularity of social cognitive theory by its capacity to help better understand and predict human behavior and to identify methods through which behavior can be changed.

The present study uses Bandura's (1986) model of triadic reciprocal causation to explore the relationships between the following:

- Behavior: knowledge sharing

- Personal factors: VLT competencies, goal orientation

- Contextual/environmental factors*:* social presence, expectation of learning in VLT, satisfaction with VLT, task type, and instructor strategies.

Behavior (B): Knowledge Sharing

Although behaviorists relate human behavior to environmental stimuli, humans do have agency in shaping their environment and behavior. Theories suggests that human behavior results both from sociocultural influences and psychological mechanisms. Actually, both external and internal factors condition individual behavior; individuals can learn from their successes and mistakes, from their own experience, and from the experience of others (Bandura, 1999). A VLT, as a collection of individuals, operates through members' behavior, which is based on their shared understanding of the purpose of being grouped in a VLT, on their individual accountability for its effectiveness, and on the consequences for the entire team if they fail to cooperate. One assumption is that VLT members understand the importance of knowledge

sharing in VLTs, and for this reason this study hypothesizes (H1) that VLT individual members will report high levels of knowledge sharing in VLTs.

Hypothesis 1: The majority of individual members will report high levels of knowledge sharing in VLTs.

Team knowledge falls into four categories (Cannon-Bowers, Salas, & Converse, 1993; Mathieu, Goodwin, Heffner, Salas, & Cannon-Bowers, 2000; Rouse, Cannon-Bowers, & Salas, 1992): (a) technology/equipment knowledge, (b) job/task knowledge, (c) team interaction knowledge, and (d) team members' knowledge. Teams share their knowledge and understanding of equipment, task, team interaction, and the team. Hinds and Weisband (2003) state that knowledge sharing in teams: (a) "enables people to predict the behaviors of team members," (b) "facilitates efficient use of resources and efforts," (c) "reduces implementation problems and errors," (d) "increases satisfaction and motivation of team members," and (e) "reduces frustration and conflict among team members" (p. 23). Predicting each other's behavior allows team members to operate on assumptions and save time checking on one another. It also enables individuals to work independently and at the same time to contribute to team outcomes. Collective effort can be minimized by effective use of resources; teams can avoid errors and duplication of efforts.

In distance education, technology knowledge is the knowledge of hard and soft technology (e.g., computers, MS Office, Internet, course management systems) that learners use for interacting and completing the tasks. It relates to VLT members' knowledge about where and how to obtain resources in their learning environment. Task knowledge is discipline specific knowledge and knowledge of task procedures and strategies. Team knowledge relate to team interactions; to the understanding of how teams work, and especially how virtual teams and

VLTs work; and to the understanding of the interdependence of team members, team members' roles and responsibilities, team interaction patterns, information resources, information flow, and communication channels. It also relates to the knowledge of team members' entry-level characteristics, skills, attitudes, preferences, strengths, weaknesses, and so on. Sharing the knowledge in the above listed areas will allow VLTs to achieve their team goals, which, in turn, will enhance team effectiveness.

A study conducted by Johnson et al. (2007) analyzed team knowledge and skills, including (a) general task and team knowledge, (b) general task and communication skills, (c) attitudes towards teammates and task, (d) team dynamics and interaction, and (e) team resources and working environment. This study will measure knowledge sharing in VLTs along the lines of sharing of general task knowledge, knowledge of team dynamics and interaction, and knowledge of VLT work environment.

Person (P): Competencies, Goal Orientation

Social cognitive theory views human beings as agents who actively design their lives by using their brain and their sensory, motor, and cerebral systems (Harre & Gillet, 1994). Human beings intentionally influence their own functioning and life circumstances by being "self-organizing, proactive, self-regulating and self-reflecting" (Bandura, 2006, p. 164). Individuals are both "producers" and "products" of social systems (Bandura, 1999, p. 21). From this perspective, the *person* has both "emergent" and "interactive" human agency because individuals "make causal contribution to their own motivation and action" (Bandura, 1989b, p. 1175) because "behavior, and thought, affect action, individual expectations, beliefs, self-perceptions, goals and intentions" (Bandura, 1989a, p. 3). Human agency can be direct or through a proxy (relying on intermediaries) or collective, that is, "operating through shared beliefs of efficacy,

pooled understandings, group aspirations and incentive systems, and collective action")
(Bandura, 1999, p. 21).

For human agency, self-efficacy is central. Two types of beliefs support individual
actions: (a) the belief that the action can produce the desired effect, and (b) the belief that the
individual has power to produce change by their action. Self-efficacy is positively related to the
level of motivation. If individuals have stronger beliefs in their capabilities, their efforts will be
more persistent when they face difficulties (Wood & Bandura, 1989).

Competencies for working on VLTs. Individuals' perceptions of their own competency
can relate to the level of their self-efficacy, although Holden, Meenaghan, Anastas, and Metrey
(2002) state that self-efficacy is more than perception of competency; they relate self-efficacy to
self-awareness and to the "individual's assessment of his or her confidence in their ability [to]
execute specific skills in a particular set of circumstances and thereby achieve a successful
outcome" (p. 116). Nevertheless, this study assumes that a higher level of VLT competencies can
boost learners' self-efficacy and impact their knowledge sharing behavior.

Many definitions of the term *competency* can be found in the literature. Boyatzis (1982)
views competency as personal characteristics that lead to or cause superior performance. Birkett
(1993) sees competency as the manner in which individual attributes, such as knowledge, skills,
and attitudes, are drawn on in performing tasks in specific work contexts. Roe (2002) views
competencies as learned abilities to perform a task, duty, or role in a particular work setting,
integrating several types of knowledge, skills, and attitudes. Competencies differ from
knowledge, skills, and attitudes because knowledge, skills, and attitudes can be developed and
assessed separately, and can be applied in multiple competencies. According to Boam and
Sparrow (1992), competency is any aspect of the inner person, normally displayed as behaviors,

which allows them to perform completely. Stephenson (1997) and Birkett (1993) prefer the term *capability*, seeing in it integration of knowledge, skills, personal qualities, and the ability to learn to deal with unfamiliar and familiar situations or tasks.

The benefit of virtual teams in organizations is that they bring together individuals with needed competencies (knowledge, skills, abilities, and attitudes—competencies), regardless of their location (Blackburn et al., 2003). Competencies for working on VLTs are those resources that individuals bring to the table. In relation to physical and virtual teams, organizational research suggests that team competencies can predict individuals' success in the workplace (Stevens & Campion, 1994; et al., 2006) by predicting their performance on teams. Although virtual teams and VLTs in distance education have certain differences due to the purpose with which they come together (learning vs. performance), contexts in which they appear (corporate vs. academic), and the tasks that they come together to complete, this study seeks to test whether the same instrument developed for measuring the competencies of virtual team members in the workplace can be applied to VLT individual members engaged in learning in distance education.

The second hypothesis (H2) follows:

Hypothesis 2: The construct that captures the competencies of individual employees working on virtual teams can be applied to VLT individual members in distance education.

Research also suggests that self-efficacy can relate to motivational factors and can predict learners' choice of activities, as well as their effort persistence and academic performance (Bandura, 1986; Pintrich & Schunk, 2001). Increased self-efficacy results in improved performance and vice versa (Velicer, Diclamente, Rossi, & Prochaska, 1990). VLT members' perceptions of their own capability to perform in a VLT environment depends on their degree of self-efficacy, which in turn affects their knowledge sharing behavior. Yang (2007) emphasizes

the bidirectional relationship between competencies and knowledge sharing, stating that "knowledge sharing occurs when an individual is willing to assist as well as to learn from others in the development of new competencies" (p. 84).

In organizational research, competency frameworks have been suggested for conducting team member selection (Blackburn et al., 2003; Ellingson & Wiethoff, 2002). The competency framework suggested by Blackburn et al. (2003) is based on the assumption that competencies needed by virtual teams are similar to the ones needed by teams working face to face. The framework groups the competencies into three categories:

1. Individual team member competencies, which consist of the following components: (a) self-management competencies (e.g., proactive behavior, self-regulation, time-management, ability to balance local and distance obligations); (b) communication competencies (e.g., sending information so that the message is heard and gathering feedback); (c) cultural sensitivity and awareness competencies (e.g., developing a shared understanding with individuals from different cultures); (d) trust competencies (e.g., developing mutual trust by enhancing trustworthiness); and (e) comfort with technology and technological change competencies (e.g., willingness to use new technologies)

2. Team-level competencies, consisting of competencies for establishing team goals and defining team rules, establishing team norms, solving team problems, managing team conflict, and balancing team relationships, task teams, and team learning

3. Team leader competencies, consisting of a combination of face-to-face team leader competencies and virtual team competencies. Face-to-face team leader competencies consist of competencies for defining the team mission, setting high expectations, shaping group culture, coaching, counseling, facilitating team meetings, mediating conflicts,

evaluating performance, motivating team members, and recognizing individual and group achievements. Virtual team leader competencies consist of serving as a role model for the team, using collaborative software, sharing information openly, choosing appropriate media for communication, and providing prompt responses to others (p. 102).

Two empirical studies have designed and validated competency frameworks for teams. Stevens and Campion's (1994) competency framework is to be used as a selection test for staffing work teams (physical). Hertel et al.'s (2006) competency framework, virtual team competency inventory (VTCI), is intended for use in selecting and placing members in virtual teams. The framework suggested by Stevens and Campion (1994) is comprised of (a) interpersonal competencies (e.g., conflict resolution, collaborative problem solving, and communication) and (b) self-management competencies (e.g., goal setting, planning, and coordination). Hertel et al. (2006) operationalized the construct of competencies as (a) task work (e.g., loyalty, integrity, conscientiousness), (b) teamwork (e.g., cooperation, communication), and (c) telecooperation (e.g., self-management, interpersonal trust, intercultural skills). In both frameworks, some areas overlap (e.g., communication) while others are presented as part of certain subconstructs. For instance, self-management competencies for physical teams are presented as goal setting, planning, and coordination, whereas self-management competencies for virtual teams are grouped under the category telecooperation and presented as persistence, interpersonal trust, learning motivation, creativity, independence, and intercultural competence. It is assumed that the differences are due to the characteristics of the environments (physical and virtual) in which team members find themselves collaborating.

Virtual environments are thought to decrease social interaction. For this reason, in virtual teams task orientation is found to be stronger (Marshall & Novick, 1995). In order to do task

work, team members need knowledge about "task procedures," "likely contingencies," "likely scenarios," "task strategies," "environmental constraints," and "task components' relationships" (Mathieu et al., 2000, p. 275). Hertel et al. (2006) consider loyalty, integrity, and conscientiousness critical for engaging successfully in task work in virtual teams. They base their judgment in selecting the components above on the suggestion made by Schmidt, Ones, and Viswesvaran (1994) that loyalty, integrity, and conscientiousness are the three attributes that "cover the general aspects of reliability of a person" (p. 483).

Schmidt and Hunter (1998) write that "integrity tests are used in industry to select employees who are less likely to drink or use drugs on the job, get into fights, steal from the employer, sabotage equipment, or engage in other undesirable behaviors" (p. 267). Hertel et al. (2006) argue that these three attributes are especially important for highly virtual teams because in those teams external and/or social control are reduced.

The teamwork competencies suggested by Hertel et al. (2006) are communication and cooperation. Effective physical teams manage to control tension and engage in informal, relaxed, and comfortable communication (Argyris, 1966; Likert 1961; McGregor, 1960), in which participants are open and supportive of one another's ideas, feelings, and perspectives (Likert, 1961). In effective teams communication is event-oriented rather than person-oriented (Gibb, 1961); it is conjunctive rather than disjunctive (everyone has equal opportunity to speak, and topics are not monopolized) (Wiemann & Backlund, 1980); it is owned rather than disowned (individuals take responsibility for their statements) (Stevens & Campion, 1994).

Hertel et al. (2006) note that in virtual teams "the importance of communication skills . . . is less obvious because face-to-face interaction is generally reduced" (p. 483). However, the findings of a study on teleworkers in health circles, conducted by Kondradt, Schmook, Wilm,

and Hertel (2000), suggest that the participants of the study made considerable effort to stay socially active to prevent isolation and exclusion. Cooperativeness is especially important for virtual collaboration because of the lack of common context in computer-mediated communication can create misunderstanding and increase the risk that someone will feel neglected (Hertel et al., 2006, p. 483).

Telecooperation competencies suggested by Hertel et al. (2006) are self-management, interpersonal trust, and intercultural skills. Self-management is based on self-knowledge, which in turn relates to intrapersonal intelligence (as in Gardner's multiple intelligences theory) (Hilt, 1992). Individuals can engage in self-management only when they have developed self-knowledge. Self-management relates to self-regulation, which in turn enables individuals to engage in mutual regulation (Dillenbourg, 1999). Though self-management is important for physical teams, it is even more important for virtual teams because virtual team members face the challenges of physical isolation, lack of mutual control, and cultural diversity (Hertel et al., 2006, p. 483). Stevens and Campion (1999) discuss self-management in physical teams as goal setting and performance management, and planning and task coordination. For virtual teams, who collaborate under restrictions imposed by the virtual environment, Hertel et al. (2006) suggested four aspects to cover self-management: (a) persistence, (c) learning motivation, (c) creativity, and (d) independence. Persistence is important for accomplishing tasks involving technology-mediated interactions. VLT members might face technology-related and other barriers towards completing the task right away, but if they are persistent, they will learn through trial and error and from feedback of their team members and their instructors. Other than this, their persistence should be obvious to other VLT members so that healthy working relationships

are created. VLT members should be capable of motivating themselves to continue working on the task—in other words, persist in learning.

Learning motivation in VLTs relates to course content, to team involvement, and to task completion methods and strategies, which might be different from the ones that VLT members previously encountered. Creativity allows VLT members to discover and develop new concepts and to find original and innovative solutions to tasks. Independence relates to their self-efficacy as Hertel et al. (2006) maintain. Self-efficacy is the "judgment about one's ability to accomplish the task as well as one's confidence in one's skills to perform the task" (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 13). Self-efficacy is especially important for VLTs in distance education because the unavailability of face-to-face interaction creates an even stronger need to be confident in one's capabilities to perform.

Interpersonal trust is the "expectancy of team members that their efforts will be reciprocated and not exploited by other team members" (Hertel, Konradt, & Orlikowski, 2004, p. 8). In distance education, where face-to-face interactions are nonexistent, trust is especially important because computer-mediated communication can create misunderstandings and can escalate the fear of exploitation (Jarvenpaa & Leidner, 1999). However, because on virtual teams it is impossible to monitor other team members (Aubert & Kesley, 2003), the only thing that individuals can do is to trust one another. The effectiveness of VLTs, then, depends on the capability of team members to deliver the promised work. They have to trust that other team members will deliver their share of the work in a timely manner and with appropriate quality. Duante & Snyder (2001) argue that trust in teams can be built through trust building activities. Most of the points discussed above relate equally to VLTs in higher education because they share a number of characteristics with virtual teams.

Intercultural skills are especially important in the current period when education and work often occur on a global level. Virtual team members can find themselves cooperating and collaborating with partners from other countries and cultural backgrounds (Duante & Snyder, 2001; Ellingson & Wiethoff, 2002), as well as with people from different educational, occupational, and functional backgrounds (Hertel et al., 2006). The same can be stated about distance education students. They can also find themselves studying with peers from different cultural backgrounds, from different majors, from different generations, living on different continents, and so on, all of which create cultures. Thus, VLT individual members with high-level VLT competencies will engage in higher levels of knowledge sharing, understanding its importance for their VLT and their common goal. Thus, this study hypothesizes (H3):

Hypothesis 3: VLT members' level of competencies for working on VLTs will have a statistically significant positive direct effect on their knowledge sharing behavior.

In this study, the construct of VLT competencies is presented through task work, teamwork, and telecooperation competences.

Goal orientation. Humans approach tasks with goals in mind. According to Wood and Bandura (1989), "Goals can improve individuals' psychological well-being and accomplishments in several ways. First, goals have strong motivational effects. Goals provide a sense of purpose and direction, and they raise and sustain the level of effort needed to reach them" (p. 367). It has been suggested that goal orientation to some extent relates both to locus of control and to self-esteem. Goal orientation may partially determine locus of control because locus of control concerns individuals' perceived control over important elements in life (Dweck & Leggett, 1988) and over rewards and/or outcomes (Rotter, 1966; Spector, 1988), whereas goal orientation concerns individuals' perceived control over the basic attributes that influence

outcomes (e.g., one's level of competence). Self-esteem relates to personal judgment of one's overall level of worth or value (Coopersmith, 1967; Rosenberg, 1965). Two major aspects of the goal orientation construct that were researched are (a) its characteristic (whether dispositional or situational) and (b) its dimensionality. There is research evidence that goal orientation has been treated as a stable dispositional trait (Ames & Archer, 1987; Diener & Dweck, 1978). However, there is also research evidence that situational aspects such as competitive reward structures (Ames, Ames, & Felker, 1977), prevalence of normative information (Jagacinksi & Nicholls, 1987), and the use of evaluative feedback (Butler, 1987) influence the type of goals that are adopted in a given setting. This is important information for instructional design because it suggests the possibility of designing instructional environments that might affect VLT individual learners' goal orientation and lead them towards better interactions in VLTs.

Two types of goals were identified as characteristic of learners in an academic context: (a) learning (mastery) goal orientation or (b) performance goal orientation. Research relates these goals to learners' adaptive and maladaptive behaviors (Anderman & Wolters, 2006). Individuals with learning goal orientation focus on developing competence (Ames & Archer, 1987); they exhibit positive coping, persistence, positive emotions (Elliott & Dweck, 1988), self-regulated learning (Graham & Golan, 1991), positive social attitudes towards others (Kaplan, 2004), and transfer of problem-solving strategies to unfamiliar situations (Bereby-Meyer, & Kaplan, 2005). For those with strong learning goal orientation, self-esteem will be enhanced by pursuit and mastery of challenging tasks (Dweck & Leggett, 1988). In other words, individuals with learning goal orientation will exhibit adaptive behavior that will "promote the establishment, maintenance and attainment of personally challenging and personally valued achievement goals" (Dweck, 1989, p. 1040).

Boyatzis (1999) views learning as a metacompetency geared towards self-directed change, which in turn leads to success and effectiveness in the 21st century, and states that "we change in the knowledge we possess and understand[ing]" (p. 15). However, possession of knowledge and understanding in turn might trigger a new learning behavior for which learning goal orientation is highly important. Learning goal orientation is thought to predict interest and intrinsic motivation (Cury, Elliot, Da Fonseca, & Moller, 2006); to relate to positive outcomes (e.g., effort and persistence) (Elliot, McGregor, & Gable, 1999); to improve retention of information learned (Elliot & McGregor, 1999); to relate to a higher level of self-efficacy (Kaplan & Maehr, 1999), and to lead to positive emotions (Roeser, Midgley, & Urdan, 1996).

VLT individual members with learning goal orientation will have intrinsic motivation to engage in knowledge sharing so that they can learn better. Thus, this study hypothesizes (H4):

Hypothesis 4: Learning goal orientation will have a statistically significant positive direct effect on knowledge sharing.

If that is the case, it is assumed that learning goal orientation will also mediate the relationship between competencies and knowledge sharing. For this reason, this study hypothesizes (H5):

Hypothesis 5: Learning goal orientation will mediate the predictive relationship between competencies and knowledge sharing.

Individuals with performance goal orientation, on the other hand, often compare themselves and their abilities to others (Nicholls, 1984). Performance goal orientation is more competitive. Performance goal-oriented individuals strive to demonstrate competence (Ames, 1992; Dweck, 1986). They are concerned with impressing others with their ability and gaining

favorable judgments about their competence. These individuals avoid exhibiting low ability or negative judgments about their competence (Dweck, 1986). For those with a strong performance goal orientation, self-esteem is built through error-free performance that is superior to that of others, or performance that does not require excessive effort (Dweck & Leggett, 1988). These individuals tend to attribute failure to their own low ability, which can result in negative affect and cause withdrawal from activity. This is an example of a maladaptive behavior (Diener & Dweck, 1978; 1980; Nicholls, 1984). It is associated with "a failure to establish reasonable, valued goals, to maintain effective striving towards those goals, or ultimately, to attain valued goals that are potentially within one's reach" (Dweck, 1989, p. 1040). VLT individual members with performance goal orientation are willing to engage in knowledge sharing to create an impression of high ability in VLTs, especially when their perception of the level of their own competencies is high. Thus, this study hypothesizes (H6):

Hypothesis 6: Performance goal orientation will have a statistically significant positive direct effect on knowledge sharing.

If that is the case, it is also assumed that performance goal orientation will mediate the relationship between competencies and knowledge sharing. Thus, this study hypothesizes (H7):

Hypothesis 7: Performance goal orientation will mediate the predictive relationship between competencies and knowledge sharing.

However, learning and performance goals are neither mutually exclusive nor contradictory, and as Button, Mathieu, and Zajac (1996) noted, "It is possible for an individual to simultaneously strive to improve one's skills and to perform well relative to others" (p. 28).

Environment (E): Learning Community, Social Presence, Satisfaction, Task Type, Instructor Strategies

Traditionally a learning environment has been defined from a physical and social perspective, and as such, it can be potential and actual. Potential environment becomes actual when it rewards or punishes individuals' behavior. VLT individual members form expectations of the environments in which their learning should occur. According to social cognitive theory, there are three types of environments: (a) imposed environments, (b) selected environments, and (d) constructed environments (Bandura, 1997). An imposed environment, which can be physical or sociocultural, is "thrust upon people whether they like it or not" (Bandura, 1999, p.23). Although individuals have little control over this environment, they have "leeway in how they construe it and react to it." In the VLT context, VLT individual members engage in all three types of environments: (a) an imposed environment can be presented by the task that VLTs are given to work on, by the strategies that instructors use to manage the classrooms, and by the virtual environment itself, (b) an environment can be selected if VLT members self-select other team members, and (c) an environment can be constructed through its psychosocial factors such as learning community and social presence. Bandura (1999) notes that "the construal, selection and construction of environments affect the nature of the reciprocal interplay between personal, behavioral and environmental factors" (p. 23).

Social presence. Social presence theory emerged on the basis of media richness theory (Short et al., 1976). In recent years, social presence has been discussed in relationship with teaching presence, cognitive presence, and learner presence (Rourke, Anderson, Garrison, & Archer 2001; Shea & Bidjerano, 2010).

Initially, media richness theory ascribed the level of social presence to the objective characteristics of the medium only, or the "quality of the medium itself," to convey degrees of social presence (e.g., facial expressions, nonverbal cues, body language), ignoring the social (subjective) aspect in mediated communication (Gunawardena & Zittle, 1997, p. 9). In recent years social presence has also been viewed from the perspective of the social aspect of computer communication, integrating into it "interaction of individual differences, task and environmental context" (Biocca, Burgoon, Harms, & Stoner, 2001, p. 12). Wong and Lai (2005) propose the concept of task-medium fit, which creates a link between media richness theory and social presence theory. According to the latter theory, social presence can be task driven in that individuals' choice of the form or type of medium to be used follows their sense of the social presence required for a particular task.

Two concepts underlie social presence: (a) immediacy (Wiener & Mehrabian, 1968) and (b) intimacy (Argyle &Dean, 1965). Immediacy refers to the degree of psychological distance between the participants (Rettie, 2003). Behaviors such as gestures (e.g., nodding), facial expressions (e.g., smiling), and body language are suggested to "enhance closeness to and nonverbal interaction with one another" (Weiner & Mehrabian, 1968, p. 213). Intimacy refers to the verbal and nonverbal behaviors that affect interpersonal interactions, and it is subconsciously maintained at equilibrium by the participants of the interaction (Argyle & Dean, 1965).

According to McGrath (1984), there are three main forms of communication cues: (a) verbal (e.g., tone, pitch, volume, rate of speech), (b) visual (e.g., body language, facial expressions), high on social presence because they are effective in conveying immediacy, and (c) textual (e.g., typed, written, and printed text and graphics), low on social presence because they convey low levels of immediacy. From this perspective, computer-mediated communication

(asynchronous) is considered a *lean* medium (Short et al., 1976). It lacks timely feedback and body language, has meaning barriers (Beers, Boshuizen, Kirschner, & Gijselaers, 2007; Derks, Bos, & Grumbkow, 2007), and possesses less capacity to convey feelings and emotions (Tu, 2002). Subjective characteristics of computer-mediated communication relate to individuals' preference for a particular form of communication medium, their becoming familiar with it, and making up for the gap in social presence created by the objective characteristics of the medium so that the level of experienced social presence can be intentionally manipulated (Polhemus, Shih, & Swan, 2001; Swan & Shih, 2005; Walther, 1996).

The literature discusses both challenges and advantages related to low social presence. On one hand low social presence can lead to lack of shared context or body language, which can cause undesired misinterpretation of written texts (Bromme, Hesse, & Spada, 2005) and can impact learners' connectivity and sense of community, because "low social presence can decrease group member performance by allowing specific comments or information to be ignored completely or at least not be used in a timely manner" (Roberts, Lowry, & Sweeney, 2006, p. 31). On the other hand it can improve the quality of discussion and result in more unique ideas (Valacich, Dennis, & Connolly, 1994) by lowering the level of inhibition in individuals so that they more freely express ideas and participate in discussions (Valacich, George, Nunamaker, & Vogel, 1994).

However, there is research evidence that social presence relates to team effectiveness. In the corporate world, members of highly productive virtual teams were found to engage in informal social communication more often than members of less productive teams (Saphiere, 1996). Social attributes in team communication are found to facilitate the formation of trust in virtual teams (Jarvenpaa & Leidner, 1999). Higher levels of social presence were found to result

in higher satisfaction with communication, greater levels of interaction, and greater opportunities for learning (Swan & Shih, 2005). A study conducted by Swan (2003) found a strong positive correlation (0.83) between students' perceived social presence and their perceived learning. Social presence is also critical for creating a community of learners (Fabro & Garrison, 1998).

Social presence relates to whether or not individuals project themselves socially and emotionally in the computer-mediated interaction (Gunnawardena, 1995). Social presence has been suggested to be an element that supports both cognitive and affective objectives of learning. High levels of social presence were found to help sustain cognitive presence (Garrison, 1997; Gunnawardena, 1995). Social presence supports the affective objectives by making the group interactions appealing, engaging, and intrinsically rewarding (Rourke et al., 1999).

Further, Haythornthwaite (2000) thinks that there might be some alternative uses of asynchronous communication that can create higher levels of social presence in online learning. Walther (1994), referring to a number of studies in which "experienced CMC users rated text-based media, including e-mail and computer conferencing, as 'rich or richer' than telephone conversations, and face-to-face conversations" (p. 9), notes that computer-mediated communication (CMC) can be "hyper-personal," rather than impersonal (p. 18), because participants use unconventional symbolic displays to add affective components to computer-mediated dialogue. According to Haythornthwaite (2000), individuals with more frequent and stronger ties can use asynchronous tools of communication synchronously. Walther (1992) argues that more frequent communication of participants through a particular communication medium may allow them to construct and enhance social presence. A "low presence" communication medium was found to become "richer" as participants developed more familiarity with it and got more accustomed to it (Walther, 1992). On the other hand, individuals

may prefer communication media, which can become more of a reason for their use of a particular medium than the amount of objective social presence that the medium carries (Yoo & Alavi, 2001).

As the discussion above suggests, social presence seems to be important in computer-mediated asynchronous communication because individuals seem to have a natural need for it. In a content analysis conducted by Angeli, Bonk, and Hara (1998), 27% of the content of total messages consisted of expressions of feelings, self-introductions, jokes, compliments, greetings, and closures. McDonald (1998) found that expressions of openness (18%) and solidarity (40%) were significant elements at the start of the conference and that those numbers increased to 36% and 54%, respectively at its conclusion. Kanuka and Anderson (1998) found a significantly high amount of social interchange occurring in a professional development conference. Gunnawardena (1995) assessed students' subjective evaluations of computer conferencing. "Sociable" received 2.23 on a 5-point Likert scale with 1 indicating a positive rating. The use of the subjective characteristics of computer-mediated asynchronous communication in turn relates to constructing of learning environment in VLTs, which this study assumes will impact VLT members' knowledge sharing behavior. Thus, this study hypothesizes (H8):

Hypothesis 8: Social presence has a statistically significant positive effect on knowledge sharing.

Because social presence can encourage interaction, it is assumed that it can also play a mediating role in the VLT knowledge sharing model. For this reason, this study hypothesizes (H9):

Hypothesis 9: Social presence will mediate the predictive relationship between competencies and knowledge sharing.

The construct of social presence is comprised of three elements: (a) affective responses, (b) interactive responses, and (c) cohesive responses (Rourke et al., 1999). Affective responses relate to "expression of emotions," "use of humor," and "self-disclosure." The words related to social presence are "warmth," "affiliation," attraction," and "openness" (p. 57). Affect is created in computer-mediated communication by the use of emoticons (☺☺☺) (Falman, 1981, cf. Rourke et al., 1999), humor (Gorham, 1988), and self-disclosure (Cutler, 1995). The absence of physical presence in computer-mediated communication can be compensated for by using unconventional symbolic representations, such as emoticons, to facilitate expressiveness in the medium (Kuehn, 1993).

Gunnawardena and Zittle (1997) found that conference participants "enhanced their socioemotional experience by using emoticons to express missing nonverbal cues in written form" (p. 8). Garrison et al. (1999) state that "emotions are inseparably linked to task motivation and persistence, and therefore, to critical inquiry" (p. 99). Humor contributes to immediacy and learning (Christenson & Menzel, 1998); it conveys good will, reduces social distance, and can invite conversation (Gorham & Christophel, 1990). Eggins and Slade (1997) find humor characteristic of casual conversation in contrast to formal and pragmatic interaction. They stated, "The construction of group cohesion frequency involves using conversational strategies such as humorous banter, teasing, and joking. These strategies allow differences between group members to be presented not as serious challenges to the consensus and similarity of the group (p. 189).

Self-disclosure is viewed as "psychological explanation of social attraction and bonding between individuals" (Rourke et al., 1999). According to Cutler (1995), "the more one discloses personal information, the more likely they are to establish trust, seek support, and thus find satisfaction" (p. 17). Computer-mediated instruction can create a feeling of social isolation, the

feelings of which could be reduced by exchanging personal information to "contribute to the formation of individualized impressions of interlocutors" (Shamp, 1991). Rourke et al. (1999) note that "a number of studies found positive correlation between use of personal examples, personal anecdotes and self-disclosure, and affective, cognitive and behavioral measures of learning" (p. 58).

Interactive responses are thought to build and sustain relationships and to express a willingness to maintain and prolong contact; they tacitly indicate interpersonal support, encouragement, and acceptance of the initiator (Eggins & Slade, 1997). Garrison et al. (2000) label this category "open communication." They describe it as "reciprocal and respectful exchanges" and suggest "mutual awareness" and "recognition of each other's contributions" as examples of open communication. Integration is meaningful when there is mutual awareness, that is, when individuals "respectfully attend . . . to comments and contributions of others." They suggest that this type of behavior is realized by "reply features to post messages, by quoting directly from conference transcripts, by directing a comment to someone in particular, and by referring explicitly to the content of others' messages." Recognition relates to the discourse that is "supportive in acknowledging individual contributions . . . reacting to specific content of the message . . . explicitly expressing appreciation and agreement . . . complementing and encouraging others" (p. 100).

Gorman and Zakahi (1990) suggest that teachers can enhance learners' affective, behavioral, and cognitive learning by praising student work and actions or by providing comments. These actions create teacher immediacy. Sanders and Wiseman (1990) studied immediacy indicators and found a significant correlation ($r = 0.55$) between "praises students' work" and the three measures of learning. Social interaction theory, on the other hand, suggests

that human needs for affiliation and self-esteem are on par with basic physiological needs (Stark, 1996). According to Rourke et al. (1999), "Complementing and acknowledging, and expressing appreciation are ways of communicating reinforcement in a text-based medium" (p. 59).

Cohesive responses are "exemplified by activities that build and sustain a sense of group commitment" (Garrison et al., 1999, p. 101). Cohesive responses are represented by phatics, salutations, vocatives, and addressing the group as "we," "our," or "us." Phatics relate to "shar[ing] feelings," and "establishing a mood of sociability" (Rourke et al., 1999, p. 59). Phatics serve to confirm ties of union, and include communicative acts such as formal inquiries about one's health, remarks about the weather, or comments about trivial matters (Bussmann, 1998). Salutations are expressions of greetings (e.g., "Hi all") (Rourke et al., 1999). Vocatives are addressing participants by name. A number of empirical studies (e.g., Christenson & Menzel, 1998; Gorham, 1988) discovered a connection between addressing students by name and cognitive, affective, and behavioral learning. Mehrabian (1969) suggests that the use of the pronouns "we," "our," and "us" connote feelings of closeness and association.

Although in recent years "social presence," as defined by the communities of inquiry framework, has been critiqued on the basis that the actual amount of knowledge coconstruction in higher education settings is questionable (Annand, 2011), the construct is still relevant to this research. In this study, social presence will be measured along three dimensions: (a) affective responses, (b) interactive responses, and (c) cohesive responses.

Learning community. Initially, research has been interested in individual learning. Individuals have been viewed as individual agency. However, especially in recent years, the focus has shifted to group learning and working with others because very often individuals find themselves in an imposed sociocultural environment where they have to cooperate and

collaborate with others towards the completion of tasks that they cannot accomplish on their own. Therefore, social cognitive theory extends human agency to collective agency because "A group's attainments are the product not only of shared knowledge and skills of its different members, but also of interactive, coordinative and synergetic dynamics of their transactions" (Bandura, 2000, p. 75). This fact raises self-efficacy to the collective level and, as the literature suggests, beliefs of collective efficacy predict level of group performance (Bandura, 2000; Feltz & Lirgg, 1998; Hodges & Carron, 1992).

In recent years, the concept of learning community has also emerged. Coming together in virtual learning teams, VLT individual members create a learning community. Learning community is considered a "cohesive community," one that "embodies a culture of learning in which everyone is involved in a collective effort of understanding" (Bielaczyc & Colllins, 1999, p. 270-271). Learning communities theory makes a particular emphasis on group learning, which, in turn, impacts individual learning. The primary goal of learning communities theory is "to advance the collective knowledge and skills and thereby to support the growth of individual knowledge and skills," and the preconditions include "diversity of expertise among the members of the learning community and an emphasis on learning how to learn." The values that the theory states are "learning how to learn," "learning how to direct one's own learning," "learning how to deal with complex issues," "learning how to work with people," "a culture of learning as a collective effort and sharing of knowledge," "a respect and appreciation for differences within the community," and "respect and appreciation for all members of the community".

A VLT is a collective agency, which ascribes collective efficacy to itself as a unit. VLT individual members expect that their VLT is capable of creating a learning community conducive to learning because they evaluate their assignment to the VLT as an opportunity to

learn through processes of socialization and social interaction—similar to Vygotsky's (1978) argument. In a related vein, Lave and Wenger (1991) consider learning an integral part of social practice. They suggest that learning occurs through purposeful sharing. Thus, in learning behavior meaning is constructed and coconstructed. VLT individual members have expectations of the learning community created within their VLT. They expect that this learning community will support them in learning. These expectations relate to VLT individual members' knowledge sharing behavior. Thus, this study hypothesizes (H10):

Hypothesis 10: *Learning community has a statistically significant positive effect on VLT members' knowledge sharing behavior.*

A VLT is a learning community. The construct of *learning community* encompasses the feelings of the VLT community regarding their interaction, and the expectations that VLT individual members have of their VLT in terms of their educational goals and team processes. It is also assumed that learning community can play a mediating role in the VLT knowledge sharing model. Thus, this study hypothesizes (H11):

Hypothesis 11: Learning community will mediate the predictive relationship between competencies and knowledge sharing.

The construct of learning community in this study presents VLT individual members' expectation of support in learning from VLTs.

Satisfaction with VLT. Satisfaction belongs to the affective domain (Cohen & Bailey, 1997; Martins et al., 2004). If a VLT is effective as a collective agency, team members will be satisfied with their teamwork experiences (Drury, Kay, & Losberg, 2003; Keyton, 1991). Graduate students' satisfaction with their VLT experiences is important for the following

reasons. First, dissatisfaction with team experiences may hurt VLT effectiveness in terms of process and product quality because there is empirical evidence that satisfaction with team experiences positively relates to teamwork quality and product quality (Campion, Papper, & Medsker, 1996; Hoegl, & Gemuenden, 2001). Second, positive or negative experiences with a VLT can impact both collective and individual agency. At the collective level, individuals might shape negative opinions about team effort, which they will take to their next team, thus creating obstacles both for themselves and for others. Knowledge sharing relates to team effectiveness, in other words, to the effectiveness of collective agency. In effective teams, team members rely on one another's knowledge (Powell, Piccoli, & Ives, 2004). However, if VLT members are dissatisfied with their VLT processes, they may be reluctant to share their knowledge with others. Thus, this study hypothesizes (H12):

Hypothesis 12: Satisfaction with VLTs has a statistically significant positive effect on knowledge sharing.

If the above is true, then it is also assumed that satisfaction with VLTs can play a mediating role between competencies and knowledge sharing. For this reason, this study hypothesizes (H13):

Hypothesis 13: Satisfaction with VLTs will mediate the predictive relationship between competencies and knowledge sharing.

The construct of satisfaction is presented through forward movement on task or goal activities and the contribution and the input of group members.

Task type. Many sources view physical and virtual teams as collections of individuals working on interdependent tasks towards a common objective as well as on complex tasks of

significant importance (Kirkman, Rosen, Tesluk, & Gibson, 2004). Poole, Seibold, and McPhee (1985) state that "group task type" as a variable "often account[s] for as much as 50% of the variance in group performance" (p. 88). Gladstein (1984) posits that effective teams have clear expectations for tasks and team member roles. Research suggests that task interactivity (Samples, 1992; Sharan & Sharan, 1992) and task authenticity (Arts, Gijselaers, & Segers, 2002) enhance the development of teamwork transferable skills in students. A group task can be characterized by its goals, criteria for completion, rules and roles that must be followed, imposed stress or time limits, consequences of success or failure, and so on (Hare, 1962; McGrath & Altman, 1966).

Ill-structured tasks and projects with several possible paths and with multiple acceptable solutions facilitate cognitive growth (Piaget, 1928; Vygotsky, 1978). While working on this type of task, learners explain the material to others, which enhances cognitive elaboration (Springer et al., 1999). Articulating their understanding, opinions, and perspectives, learners reflect on new knowledge, defending and justifying own position (Choi et al., 2005). Explaining ideas to others allows individuals to reevaluate and externalize ideas, which in turn helps them develop metacognitive knowledge, that is (a) "knowledge of their cognition," (b) "knowledge about the specific cognitive demands of varied learning tasks," and (c) procedural knowledge of when and where to use acquired strategies" (p. 484). Thus, collaboration supports both learners' "conceptual understanding," and "the emergence of new metacognitive beliefs about knowing" (Dillenbourg et al., 1996, p. 16). While engaged in teamwork learners collaboratively develop concepts, visions, and so on—in other words cocognition. Additionally, they reflect upon own performance while in groups. (Costa & O'Leary, 1992).

As research suggests, each task is unique with regard to the above-discussed features (Saavedra, Earley, & Van Dyne, 1993), and the amount of coordination in teams depends on the

level of team members' task interdependence. When task interdependence increases, the impact of team coordination on team outputs also increases (Cheng, 1983).

Groups can use technology adaptively with different types of group tasks. Adaptive use of technology is supported by adaptive structuration theory (DeSanctis & Poole, 1994). Groups may choose to use certain features of technology and to neglect some others depending on task types. Task types also relate to the use of different levels of media richness. Tasks that need expression and perception of emotions, coordination of team members' activities, persuasion, consensus, and so on will require the use of richer media (Chaiken & Eagly, 1983; Short, Williams, & Christie, 1976). Basing their judgment on this argument, Hollingshead et al. (1993) suggest that it is very important to examine the compatibility of task types with virtual teaming.

Task type has also been related to decision making success and speed in virtual teams (Daly, 1993; El-Shinnawy & Vinze, 1998). Working on ambiguous tasks creates both benefits and challenges for virtual teams. The benefit is seen in the quality (better) of the developed goals, and the challenge is seen in the amount of time (more) than virtual teams use to reach shared goals compared to physical teams (Straus & McGrath, 1994).

Various task categorization schemes have been proposed in the group literature (Hackman, 1976; Hackman & Morris, 1975; McGrath & Altman, 1966). From the attempt to predict the impact of computer-mediated communication and task type on group task performance, the task classification theory (McGrath & Hollingshead, 1993) emerged. Integrating the various approaches, McGrath (1984) suggests a circumflex model, which groups task types into four quadrants or circumflex: (a) generate, (b) choose, (c) negotiate, and (d) execute. The *generate* quadrant refers to idea and plan generation. It is comprised of two subcategories: (a) creativity tasks (e.g., generating novel ideas) and (b) planning tasks (e.g.,

generating plans). Team members can individually contribute ideas. Each individual idea will add to the ideas in the team. This quadrant requires little or no coordination and no consensus, and regulating discussions or conveying reactions to ideas are unimportant. For this quadrant, social context cues have little impact on group performance. The *choose* quadrant is comprised of two subcategories: (a) intellective tasks (e.g., solving problems with correct answers), and (b) decision making tasks (e.g., deciding on issues without correct answers).

According to Hollingshead et al. (1993), in contrast to generative tasks, the outcomes of intellective tasks can be more affected by communication media because group consensus is required in them, although the effect can be minimal because the tasks have correct answers and, if one team member finds the correct answer, it will mean that the team solved the task. In this scenario, the need to coordinate members' activities and regulate discussions may be limited. The *negotiate* quadrant is comprised of two subcategories: (a) cognitive conflict tasks (e.g., resolving conflicts of viewpoints) and (b) mixed-motive tasks (e.g., resolving conflicts of interests). The *execute* quadrant is comprised of two categories: (a) performances/psychomotor tasks (e.g., executing performance tasks) and (b) contests/competitive tasks.

However, as research suggests, despite the fact that different task types exist, some seem to be implemented more in empirical studies than others. Hollinger and McGrath (1995) reviewed 50 empirical studies of computer-assisted groups. They found 69 tasks being discussed in 50 studies (some studies used more than one task type). The following numbers were found on different task types in those 50 studies: 13 studies used decision making tasks (e.g., tasks with no explicit correct answers); 17 studies used creativity tasks; 1 study used mixed-motive task, and in 4 studies task descriptions are missing. None of the 50 studies used competitive tasks or

performance tasks, and the experimental studies used judgment, consensus, or brainstorming tasks.

A study by Weite, Jackson, Diwan, and Leonardi (2004) suggests that when groups come together to work on a given task there are four obvious tactics that they can try: (a) "sequential segmentation" (e.g., "I work on it for a while, then pass it along to you"), (b) "parallel segmentation" (e.g., "We break it up and everyone does a piece," (c) "natural selection" (e.g., "We each carry it out and then choose the best result, or we choose the best person and let them do it"), and (d) "collaboration" (e.g., "We interact closely during the task"). The authors suggest that in each of the first three cases the group members can effectively work alone. This study also identified some students' preference to work alone rather than join groups (pp. 12–13). A conclusion that could be made from the discussion above is that task type can also relate to VLT members' knowledge sharing behavior. Thus, this study hypothesizes (H14):

Hypothesis 14: Task type will have a statistically significant positive effect on knowledge sharing.

It is also assumed that task type will mediate the relationship between competencies and knowledge sharing. For this reason, this study hypothesizes (H15):

Hypothesis 15: Task type will mediate the predictive relationship between competencies and knowledge sharing.

In this study, the construct of task type will relate to the level of task interdependence.

Instructor strategies. Instructor strategies are supported by the mediation theory of learning that is a central concept in sociocultural theories of learning (e.g., Engestrom, 2001; Vygotsky, 1978). According to Vygotsky (1978), mediation can happen if the acting subject

engaged in an object-oriented activity receives support from knowledgeable others. The concept of mediation is closely related to scaffolding. Summarizing the literature on scaffolding Ormrod (2004) notes that scaffolding relates to the provision of structure and guidance to learners by more competent others while they are engaged in activities and perform tasks (e.g., assist in developing a plan, dividing the task into smaller tasks, providing guidelines on how to accomplish the task, providing frequent feedback, etc.). Instructor strategies also relate to teaching presence (Garrison, Anderson, & Archer, 2001). There is research evidence that instructor strategies or teaching presence relates to high cognitive presence in learners (Shea & Bidjerano, 2008). Related to groupwork processes, instructor strategies can include assisting group formation, building a sense of connectedness, being involved in in-group processes, and evaluating group processes (Koh, Barbour, &Hill, 2010).

Actually, instructor strategies can serve as an environmental influence and, as Bandura (1989a) suggests, environmental influences can "partly determine which forms of behavior are developed or activated" (p. 5). Instructors have the power and authority to design a course, to assign students to VLTs, to control and direct activities in VLTs, to make decisions about the level of autonomy they are willing to provide VLTs, their level of involvement with VLTs, and to assist VLTs in passing through the different processes of the course. The type of teaching methodology that the instructor might use in virtual classrooms (teacher-centered, learner-centered, or learning-centered) encourages different behaviors in learners. Instructor strategies can be directed both towards general course management and towards supporting collaboration in VLTs. This study assumes that, with the understanding of the importance of using VLTs for collaborative learning in distance education, instructor strategies will relate to knowledge sharing in VLTs. Thus, the study hypothesizes (H16):

Hypothesis 16: Instructor strategies have a statistically significant positive effect on knowledge sharing.

It is also assumed that instructor strategies will mediate the relationship between competencies and knowledge sharing. For this reason this study hypothesizes (H17):

Hypothesis 17: Instructor strategies will mediate the predictive relationship between competencies and knowledge sharing.

In this study, the construct of *instructor strategies* is presented through strategies for (a) assisting group formation, (b) building a sense of connection, (c) being involved in in-group processes, and (d) evaluating group processes.

Now, this research explores whether all the constructs discussed above can behave as subconstructs in the VLT knowledge sharing model. Thus, the study hypothesizes (H18):

Hypothesis 18: The model of knowledge sharing on VLTs will be comprised of subconstructs knowledge sharing, VLT competencies, learning goal orientation, performance goal orientation, social presence, learning community, satisfaction with VLT, task type, and instructor strategies.

Demographics. Chapter 1 discussed how demographics can relate to VLT members' knowledge sharing behavior. For this reason, this study seeks to determine whether they will affect the model structure. Thus, this study hypothesizes (H19):

Hypothesis 19: The model of knowledge sharing on VLTs tested with demographic and general variables (e.g., gender, ethnicity, age, academic level, and study area) will yield identical results.

Summary

For this research, Ford's (2004) study on actual knowledge sharing has been central, although the present study explored VLT members' perceptions of their knowledge sharing behavior on VLTs in distance education rather than individuals' actual knowledge sharing behavior in a nonacademic context. Ford (2004) used the theory of reasoned action as a theoretical framework. Initially, studies on knowledge sharing that used the theory of reasoned action were reviewed. The researcher concluded that the theory of reasoned action could not be used as a theoretical framework for this study because the focus in this research is on antecedents other than VLT members' beliefs, attitudes , and intentions to share knowledge. In other words, this study sought to explore not just the individual behavior, but also the individual behavior embedded in a social context, for which Bandura's (1986) social-cognitive theory and model of triadic reciprocal causation seem to offer better support. This chapter used the model of triadic reciprocal causation to place the variables of interest under the three categories of person, environment, and behavior. It also provided insights into the relationship between the subconstructs in the study and stated the hypothesis to be tested. While the model of triadic reciprocal causation allows one to look at bidirectional relationships between the variables, the focus of the study is the unidirectional relationships between the variables of interest. The next chapter presents the research design, research context, population, and sample. It presents the variables and measures. Additionally, it presents the pilot study, the data gathering procedures, and the analyses that the study used.

CHAPTER 3: METHODS
Introduction

This study is designed to answer the question, Which factors contribute to knowledge sharing in virtual learning teams (VLTs)? The previous chapter discussed empirical research on knowledge sharing, provided the rationale for choosing the theoretical framework for the study, took a closer look at the variables of interest, and stated the hypotheses. This chapter describes the research design, context, population, and sample, and the variables and their corresponding measures. Additionally, it presents the pilot study, data collection steps, and the analyses used in the study. The chapter concludes with a summary.

Research Questions

The primary research question in the present study is, *Which factors contribute to knowledge sharing in virtual learning teams (VLTs)?* The secondary research question in the study is, *Could the same VLT knowledge sharing model be applied to learners with different characteristics?*

Research Design

This study used a split sample design. It used stratified sampling methodology to select participants and an electronic questionnaire to gather responses from them. Cox (1975) suggests that the split sample method yields lower bias and runs a close second in terms of power to multiple comparisons, based on Bonferroni inequality, and that the split samples are more flexible and perhaps more easily adapted to complex settings. The unit of analysis in this study is the VLT individual member. The study gathered VLT members' perceptions on a number of variables using an electronic questionnaire survey.

Data Collection Instruments

Measure of Knowledge Sharing (KSHARE)

Knowledge sharing is defined as imparting expertise, insight, or understanding to another individual or a group with the intention that the recipient may have that knowledge in common with the sharer. This variable has been measured using a scale adopted from Johnson, Lee, Lee, O'Connor, and Khalil (2007) and slightly adapted for the use in an academic context. This study uses 14 out of the 42 items included on their scale. The 42 items on the scale suggested by Johnson et al. (2007) are loaded on four factors. The 14 items for this study are selected from items loading on three factors: (a) general task and team knowledge (7 items); (b) knowledge of team dynamics and interactions (5 items), and (c) team resources and team environment (2 items). One item (item 15) on course-related knowledge was added as sharing of "your course related information" and categorized under Resource and Environment. Johnson et al. (2007) utilized a 5-point Likert scale ranging from 5 = "strongly agree" to 1 = "strongly disagree." Based on the idea of knowledge sharing and hoarding discussed by Ford (2004), a 5-point Likert scale was created: 5 = "shared everything I knew or had," 4 = "shared more than withheld," 3 = "shared and withheld about equally," 2 = "withheld more than shared," and 1 = "withheld everything or nearly everything that I knew or had." Johnson et al. (2007) reported a Cronbach's alpha of .82 for the scale (see the scale in Appendix D, Section 5).

Measure of Competencies (KSAs)

Competencies in this study are defined as knowledge, skills, and attitudes/abilities of VLT individual members that support their effective engagement in virtual collaboration. VLT competencies have been measured using the virtual team competency inventory (VTCI) developed by Hertel et al. (2006). VTCI is an Internet-based measure for selection and placement

of members of virtual teams. The complete VCTI instrument assesses three areas of competence: task work, teamwork, and telecooperation. The task work competency model is a three-factor model (loyalty, integrity, conscientiousness) with 11 indicators loading on the three factors. The teamwork competency model is a two-factor model comprised of four indicators measuring communication skills and four indicators measuring cooperation. The telecooperation competency model has six factors (creativity, learning motivation, persistence, interpersonal trust, independence or self-efficacy, and intercultural competencies) with 20 items loaded on the six factors.

VCTI uses a 6-point Likert scale in which 1 = "not at all true," 2 = "not true," 3 = "middle rate/marginal," 4 = "true," 5 = "very true," and 0 = "question not applicable to my team." Because the unit of the study was the individual rather than a team, the instrument was used as a 5-point Likert scale because the sixth point, "question not applicable to my team," was not used. Hertel et al. (2006) did not include intercultural competencies in the model. They pilot tested the instrument with 11 factors and reported that intercultural competencies showed too many missing values. They explained this by the fact that most of the participants of their study were German and the teams did not have much experience with intercultural collaboration. This study analyzed all 11 factors with the assumption that distance education students have opportunities to work with students from other countries as well. The reported scale reliability coefficient is a Chronbach's alpha of .92. Hertel et al. (2006) also report good convergent and discriminant validity for the instrument. The scale asks participants to describe themselves in a team environment (e.g. integrity: "Following rules is important to me," and learning motivation: "Complex topics fascinate me") (see the scale in Appendix D, Section 3).

Measure of Goal Orientation (LG, PG)

Goal orientation in this study is defined as VLT members' (a) learning goal orientation and (b) performance goal orientation. The two goal orientations were measured as independent variables because an initial correlation analysis performed on them showed a rather weak correlation of (.17). The goal orientation scale (both learning and performance) was designed by Button, Matheieu, and Zajac (1996). The scales of both measures contain eight items each. Both scales use a 7-point Likert-type scale ranging from 1 = "strongly disagree" to 7 = "strongly agree." The learning goal orientation reports a Chronbach's alpha of .85 and performance goal orientation reports a Chronbach's alpha of.82. In this study, both scales (for learning orientation and performance orientation) were used with a 5-point Likert scale in which 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree" as in the original study. The learning goal orientation scale offers items that identify whether VLT members can work on difficult tasks, do challenging work, and so on (e.g. "The opportunity to do challenging work is important to me"). The performance goal orientation scale offers items that relate to individuals' competitive behavior (e.g., "I prefer to do things that I can do well rather than things that I can do poorly") (see the scales in Appendix D, Section 2: LG-odd numbers; PG-even numbers).

Measure of Social Presence (SOPRE)

Social presence is defined in the study as the extent to which learners project themselves socially and emotionally in their virtual learning team. Social presence was measured using 14 out of 15 items on the social presence scale used by Rourke (2000). The scale presents three areas or domains of social presence: affective responses, interactive responses, and cohesive responses. Rourke (2000) used a 4-point Likert scale of "almost always," "often," "rarely," and

"never." The source does not provide a scale reliability coefficient. In this study, the social presence scale was used with a 5-point Likert scale of 5 = "always," 4 = "usually," 3 = "about half the time," 2 = "seldom," and 1 = "never." Items on the scale were slightly reworded to make them applicable to the VLT context. The scale reliability coefficient is not reported in the source. The social presence scale asks how participants' most recent VLT members interacted (e.g., "Referred to other members by name," "Expressed agreement with something another team member wrote") (see the scale in Appendix D, Section 6).

Measure of Learning Community (LRNCOM)

Learning community is defined as an intrateam community that is created within a VLT and that supports the learning of the team members by offering feedback, encouraging open communication, and raising the individual members' learning motivation so that they can meet their educational goals. Learning community has been measured using the learning component of the classroom community scale (CCS) suggested by Rovai (2001). The learning component is comprised of 10 items. The CCS uses a 5-point Likert scale in which 4 = "strongly agree," 3 = "agree," 2 = "neutral," 1 = "disagree," and 0 = "strongly disagree." Even items on the scale (e.g., 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20) measure learning. Rovai (2002) prescribes different weights for different items on the scale. Items 2, 6, and 16 are scored as strongly agree = 4, agree = 3, neutral = 2, disagree = 1, and strongly disagree = 0; and items 4, 8, 10, 12, 14, 18, 20 are scored as strongly agree = 0, agree = 1, neutral = 2, disagree = 3, and strongly disagree = 4. A Cronbach's alpha of .87 and an equal-length split-half coefficient of .80 were reported on the learning scale. The scale was slightly reworded to be applicable to the VLT context. For instance, the item "I felt that I am encouraged to ask questions" was changed to "I felt that I was encouraged to ask questions in my VLT." The scale was used with a Likert scale in which 5 =

"strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and "1 = "strongly disagree" (see the scale in Appendix D, Section 4: even numbers)

Measure of Satisfaction (SAT)

Satisfaction is defined as VLT individual members' satisfaction with their VLT and its processes. Satisfaction has been measured using items from the global satisfaction-dissatisfaction scale suggested by Keyton (1991). The global satisfaction-dissatisfaction scale is comprised of 24 satisfaction items and 14 dissatisfaction items. The internal reliabilities for satisfiers are reported to range from .53 to .61 and for dissatisfiers from .80 to .88. Keyton (1991) conceptualizes satisfaction as a global construct and dissatisfaction as a specific construct, arguing that team members *know* "more specifically when they are dissatisfied than when they are satisfied in group interaction" (pp. 208–209).

This study adopted eight satisfaction items and two dissatisfaction items from the 38-item satisfaction-dissatisfaction scale suggested by Keyton (1991). The dissatisfaction items were reverse coded. Some of the items were slightly reworded to be applicable to the VLT context. The measurement also used a 5-point Likert type of scale in which 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree." The satisfaction scale offers items such as "My VLT accomplished our team goal" or "My VLT members interacted well with one another" (see the scale in Appendix D, Section 4: odd numbers)

Measure of Task Type (TTYPE)

Task type is defined through the level of task interdependence. It was measured using a six-item scale adopted from Sharma and Yetton (2003), who in turn adopted it from Pearce,

Sommer, Morris, and Frideger (1992). All the items on the scale were rated on a 5-point Likert-type scale in which 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," and 5 = "strongly agree." The instrument reported an average intraclass correlation of .90 for the raters, which indicates a high degree of inter-rater reliability. For this study, some slight rewording of the scale was done to make it applicable to the VLT context. For instance, the item "It is rarely required to obtain information from others to complete this task" was reworded to "It was rarely required to obtain information from other team members to complete team tasks" (see the scale in Appendix D, Section 7: items 2, 5, 7, 8, 10, 11).

Measure of Instructor Strategies (INST)

Instructor strategies are defined as the strategies of a course instructor that support collaborative learning. Instructor strategies were measured using the concepts found in the study by Koh, Barbour, and Hill (2010). The study reported a number of instructor strategies that could be implemented to assist students in online group work. Eight items were designed to measure instructor strategies. The instructor strategies measure has been used with a 5-point Likert scale in which 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree." One item on the instructor strategies scale had been reverse coded. The scale asked participants to describe instructor strategies in the online course in which they worked with their most recent virtual teams (e.g., "Instructor provided multiple communication methods for VLTs" and "Instructor addressed teamwork processes, strategies and characteristics") (see the scale in Appendix D, Section 7: items 1, 3, 4, 6, 9, 12, 13, 14).

Table 3.1 below presents all the measures in the study. The researcher received
permission from the authors for the use of measurements used in this study (see Appendix B and
for permissions and Appendix C).

Table 3.1

Measures in the Study

Measurement	Variable	Source	Number of items	Reliability
Knowledge sharing	B[1]	Johnson, Lee, Lee, O'Connor, Khalil, & Huang (2007)	14+ 1[2]	0.82
Competencies	P	Virtual team competency inventory (VTCI) (Hertel, Konradt & Voss, 2006)	39	0.92
Learning goal orientation	P	Goal orientation scale (Button, Mathieu, & Zajac, 1996):	8	0.85
Performance goal orientation	P	Goal orientation scale (Button, Mathieu, & Zajac , 1996):	8	0.82
Learning Community	E	Learning scale (CCS, Rovai, 2002)	10	0.93
Social presence	E	Items adopted from Rourke (2000)	14	N/A
Satisfaction with VLT	E	Global satisfaction scale (Keyton, 1991)	10	0.94
Task type	E	Adopted from Sharma & Yetton (2003)	6	0.9
Instructor strategies	E	Items adopted from Koh, Barbour, & Hill (2010)	8	N/A
TOTAL			118	

Research Context

The study was conducted using survey research among students attending an online university
offering several program majors through distance education. This university has been selected

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[1] B= behavior; P=person; E=environment

[2] One item, KS15 was added to the scale by the researcher to measure sharing of course content knowledge.

because the researcher has four years of experience of working with this university as a faculty

and used virtual learning teams in teaching. The populations for this study are the students

participating in bachelor, master, and doctoral degree programs. The courses that the university

offers are intensive, ranging from five to eight weeks. The university only permits students to

take courses within their academic-program degree level. Typical class size ranges from 15 to 25

students, although some classes, because of their nature, have as few as 6 or as many as 30

students. The university uses a competency-based instructional model and standardized course

syllabi across disciplines with similar schedules of learning activities. Instructors use

standardized feedback forms provided in the gradebook and standardized feedback timing (i.e.

they provide feedback at the end of each online week) across disciplines. The university has a

strong emphasis on collaborative learning. 30% of the final grade is assigned for learning team

assignments. Learning Team assignments are designed to enhance students' mastering academic

content and building interpersonal skills. These skills are acquired through virtual learning teams

and are intended to equip students for practical workplace situations. Instructors may assign

students to virtual learning teams or grant students' requests to work in certain established teams.

Virtual learning teams are to be composed of three to five members who engage in collaborative

efforts throughout five to eight weeks of instruction. Virtual learning teams work on a number of

assignments during the course. The working space for VLT is the team forum, where students

can post messages to individual members and to the entire team. During the first week, VLT

members create a team charter, which allows them to conduct inventory of team skills, as well as

set team rules for communication, cooperation, conflict resolutions and so on. Team members

have the right to exclude the name of a team member from the assignment if he or she does not

contribute to its completion. After completing a team assignment, at the end of each learning

team week, VLT members conduct an evaluation using a university provided evaluation form in which they evaluate both their own and their team members' contribution to the team assignment.   The instructor enters the same assignment grade for each team member unless otherwise directed by common consent of the learning team or based on own observation.   For instance, if the VLT members are critical of any team member in their evaluations, or if the instructor's observation of the team processes suggests that a team member did not make considerable contribution to the completion of the team assignment, the instructor can assign lower points to him/her. At the end of each course, students complete an end-of-course survey, in which they comment whether they would recommend the instructor to other students, whether they are satisfied with the instructor's feedback and so on. Additionally, once a year the university conducts classroom performance review for the instructors. The review evaluates instructors' class participation or facilitation, feedback provided to students, instructors' professional behavior, classroom management and so on.

Population of Interest and Samples

Sampling Criteria

The learners defined in this study are students enrolled in distance education programs for the year 2011 in the online university. They take their courses entirely through web-enhanced instructional models without residency requirements. Four criteria were considered during the sample recruitment: (a) gender, (b) academic level, (c) area of study, and (d) prior experience with at least one VLT at the point of completing the survey. The first variable, gender, includes two levels, male and female. According to the literature, males and females differ in a number of ways, including preferences for the type of interaction, independence or fulfillment of independence needs, and willingness to share knowledge with others. For this reason, the study

tried to recruit equal numbers of males and females so that gender could be measured in the study. The study sought to test whether gender would yield a different model structure.

The second variable, academic level, includes two levels, undergraduate and graduate, the latter representing learners in master's and doctoral programs. The study hypothesizes that academic level relates to individuals' experience of working with VLTs and their knowledge sharing behavior. Therefore, the study tried to recruit an equal number of undergraduate and graduate students. The study sought to test whether academic level would yield a different model structure.

The third variable, area of study, includes five levels: business, computer and information technology (IT), education, health and nursing, and law. Recruiting participants from five different majors had two purposes. First, the study hypothesized that domain-specific knowledge and task type for different academic majors would lead to differences in VLT members' knowledge sharing behavior. Second, it was assumed that recruiting representatives from different areas of study would increase the generalizability of the results. The study sought to test whether area of study would yield a different model structure. Additionally, the study tested the structural model with ethnicity and age groups.

Subject Recruitment

The research proposal was granted an exempt IRB review from Syracuse University and the University of Phoenix Online (UoP). The researcher worked with a UoP representative who sent invitations to on behalf of the researcher to a random sample of its general population engaged in distance education during academic year 2011. Stratified random samples of 20,023 distance education students were pulled from the following five program areas: business, education, criminal justice, nursing, and information technology. The samples were stratified by

program levels: bachelor, master, and doctoral (when offered). Table 3.2 shows the number of

survey invitations by program major and program level.

Table 3.2

Survey Invitations by Program Major and Level

Program Major	Bachelor level	Master level	Doctoral level	Total
Business	3,000	1,500	500	5,000
Education	3,000	1,500	500	5,000
Criminal justice	4,000	1,000	- - -	5,000
Nursing [3]	1,750	600	323*	2,673
Information technology	1,750	600	- - -	2,350
Totals	13,500	5,200	1,323	20,023

Data Collection

Preparing Data Collection Instrument

The questionnaire was comprised of 132 items out of which 118 items related to the

variables of interest; and 14 demographic and general information items helped to describe the

participants in the study and to run some additional analyses. Some participants reported

completing the survey in 15 to 20 minutes.

The data collection instrument was pilot tested twice before the data gathering stage. The

first time it was pilot tested as a paper-based questionnaire with three graduate students. The face

validity and the content validity (relatedness of the instrument to online collaboration) were

evaluated. The time required to complete the questionnaire was also documented. Some changes

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[3] All doctoral level nursing students were invited.

in the format of the questionnaire were made. The second pilot test was also conducted with three graduate students using the electronic questionnaire uploaded on ADOBE Forms Central. Based on the feedback received from the participants in the second pilot test, the instrument was finalized.

Instrument Administration

The electronic instrument was uploaded on ADOBE Forms Central. The letter of invitation containing the link to the ADOBE Forms Central where the survey was uploaded was sent to the potential participants. The first page of the questionnaire presented the informed consent. Only after reading the informed consent and checking their understanding did the questionnaire allow the participants to proceed to the next page. The study gathered responses from 1,374 participants in 29 days during January and February 2012.

Data Storing

Participation was not tracked. Data were collected anonymously. No personal or identifying information linking the data to participant's identity was collected. All the data were stored in the researcher's computer.

Analytical Methods

The data in the study were analyzed using IBM® SPSS®Statistics20, and IMB® SPSS® AMOS™ 19. Before the data were analyzed, they were screened for (a) missingness in the dataset, (b) case-based missingness, (c) variable-based missingness, (d) random missingness, (e) normality, and (f) colinearity. A few cases that were assumed to cause problems were eliminated, and the missing data were imputed. Additionally, cases were screened for participation eligibility. Once the data were cleaned the analysis methods listed below have been employed.

Descriptive analysis. Central tendency, dispersion, and distribution of the data were described. Frequency analysis of knowledge sharing behavior in VLTs was performed.

Scale reliability analysis. As stated earlier in the paper, most of the measures in the study had been validated in previous research. However, a reliability analysis on different scales was conducted because, first, from some scales items were included selectively, and second, the instruments were being used in a different context and with a different population.

Multiple regression analysis. At the front end, simultaneous multiple regression analysis was performed to identify those constructs that are significant predictors of knowledge sharing behavior in VLTs. With this purpose, knowledge sharing was regressed on the key variables. The rationale for the simultaneous method of entry was that, at this point, it was necessary to obtain a simple picture of the possible effect of the different predictors on knowledge sharing. The regression weights in the study were evaluated against the criteria suggested by Keith (2006):

- below .05: too small an effect to be considered meaningful;

- .05 and above: a small but meaningful effect;

- above .10: a moderate effect, and

- above .25: a large effect.

The multiple regression analysis was performed with the total sample of N= 1355.

Structural equation model technique. The subconstructs and the model of VLT knowledge sharing were estimated using IMB® SPSS® AMOS™ 19. The analysis of the structural equation model proceeded through the following steps:

1. Through confirmatory factor analysis (CFA) subconstructs were estimated to determine if the indicators were empirically related to the constructs. Three of the five constructs, that is, competencies for working on VLTs, social presence, and knowledge sharing were entered into confirmatory factor analysis as second-order hierarchical models; whereas learning community and task type were entered into confirmatory factor analysis as first-order models. The purpose of CFA is "to identify latent factors that account for the variation and covariation among a set of indicators" (Brown (2006, 40-41). CFA allows one to perform goodness-of-fit evaluation. Discussing recent trends in factor analysis, Russell (2002) notes that CFA is a "more appropriate" (p. 1643) method than exploratory factor analysis for testing whether the proposed factor model fits the data or not. For the confirmatory factor analysis (CFA) the sample was split in half as Sample A ($N = 664$) and Sample B ($N = 691$), randomly selected from the total sample of $N = 1,355$. Once the models were identified with Sample A, they were re-estimated with Sample B.

2. The measurement model was designed.

3. The subconstruct of social presence showed poor fit in the model and was reidentified using exploratory factor analysis (EFA) and re-evaluated using confirmatory factor analysis (CFA). For this analysis also the split sample was used.

4. The revised knowledge sharing model was evaluated. For this analysis the total sample of $N= 1,355$ was used.

5. The structural model was cross-validated through mutigroup analysis.

For this analysis the following groups of respondents were used: females ($N = 974$) versus males ($N = 368$); undergraduates ($N = 613$) versus graduates ($N = 644$); White/non-

Hispanic (N = 936) versus Black/African American (N = 236); age 24–35 (N = 387) versus 45–50 (N = 343); business major (N = 306) versus education major (N = 365) versus health and nursing major (N = 204).

Schreiber, Nora, Stage, Barlow, and King (2006) conducted a review of articles published between 1989 and 2004 that used CFA and SEM. They identified certain gaps in reporting the research caused by insufficient detailed information on the methods. This study attempts to avoid these gaps by providing sufficient information about all the steps in the analysis.

Model Fit Indices and Matrices Used

Three categories of indices for evaluating model fit were suggested: (a) indices of absolute fit (e.g., chi-square), (b) indices of parsimony (e.g., RMSEA), and (c) indices of comparative or incremental fit (e.g., TLI, CFI, PCFI) (Brown, 2006). Hu and Bentler (1999) suggested reporting one index from each category. This study used the following indices.

Chi-square ($\chi2$). χ^2 is the classical fit index, but it is sensitive to sample size (Schumacker & Lomax, 2004), and with large samples the analysis can result in a large value of χ^2; the solutions can be rejected even if the differences between the hypothesized model and the observed model are negligible. For this reason, χ^2 is rarely used as a sole index of model fit (Brown, 2006). To address the limitation of χ^2, a number of other indices were considered.

p- value. For a model to show a good fit to the data, the model should show a high *p*-value (above .05). However, Brown (2006) points out that with large sample sizes and with complex models it is difficult to get a high *p*-value. For this reason, it is important to look at PCLOSE (i.e. the index for identifying the close fitting model), whose value should be above .05

(Brown, 2006) for the model to show close fit to the data. This study attempted to obtain PCLOSE ≥ .05.

CMIN/DF. CMIN/DF is the ratio of the minimum discrepancy to degrees of freedom**.** The following ratios for CMIN/DF were suggested: acceptable fit—2:1 or 3:1 (Carmines & McIver, 1981), reasonable fit—from 2:1 to 5:1 (Marsh & Hocevar, 1985), inadequate fit—larger than 2:1 (Byrne, 1989), minimally plausible model—lower than 2:1 (Bryne, 1991). It was suggested to evaluate model fit by looking at yet other indices. This study attempted to obtain a CMIN/DF of ≤ 5.0

Akaike information criterion (AIC). AIC is a cross-validation index which tends to select models that would be selected if results were cross-validated to a new sample. AIC was used to compare non-nested competing models. Models with lower AIC were judged to fit the data better (Brown, 2006, p. 180). For this reason, the values for AIC were reported along with the results of the SEM model analysis.

CFI and TLI. CFI is a comparative fit index; TLI is the Tucker-Lewis index; and PGFI is the parsimony goodness-of-fit index. CFI evaluates the fit of a user-specified solution in relation to a more restricted, nested baseline model. This is a "null" or "independent" model in which the covariances among all input indicators are constrained to zero, although no such constraints are placed on the indicator variances (Brown, 2006). Bentler (1990) suggests using CFI so that sample size can be taken into account because the previous index, NFI, had shown a tendency to underestimate fit in small samples. TLI has features that compensates for model complexity (Brown, 2006). Both CFI and TLI range from 0.0 to 1.0. Hu and Bentler (1999) suggest using more stringent criteria for evaluating model fit by raising .90 to .95 or greater. This study attempted to obtain CFI and TLI of 95 or above.

PGFI. PGFI was introduced by James, Mulaik, and Brett (1982) to address the issue of parsimony in SEM. It contains two pieces of information: (a) the goodness-of-fit of the model (as measured by the GFI), and (b) the parsimony of the model. As the first of a series of "parsimony-based indices of fit" (see Williams & Holahan, 1994), the PGFI takes into account the complexity (i.e., the number of estimated parameters of the hypothesized model in the assessment of overall model fit). Thus, two logically interdependent pieces of information, that is, the goodness-of-fit of the model measured by the GFI and the parsimony of the model, are represented in the single-index PGFI, thereby providing a more realistic evaluation of the hypothesized model (Mulaik et al., 1989, p. 439). The exact values of PGFI are not reported. For this reason, this study attempted to obtain PGFI values as low as possible. This study attempted to obtain CFI and TLI values over .95.

Root mean square error of approximation (RMSEA). RMSEA is an "error of approximation" index. It assesses the extent to which a model fits reasonably well in the population (Brown, 2006, p. 83). RMSEA is relatively insensitive to sample size. Its value ranges from zero to 1.0. A number of values of RMSEA are suggested for the levels of model fit. Browne and Cudeck (1993) suggest these values: RMSEA $\leq$ .08 (adequate fit); RMSEA < .05 (good fit); RMSEA > .1 (poor fit; model to be rejected). MacCallum, Browne, and Sugawara (1996) suggest these values: RMSEA .08 to 0.10 (mediocre fit) and RMSEA $\leq$ .05 (acceptable fit). Hu and Bentler (1999) recommend a criterion of RMSEA $\leq$ .06 or below. Brown (2006) suggests that RMSEA $\leq$ .05 shows a close fit. The literature also suggests that with a small sample size RMSEA of .08 may be of less concern if all the other indices suggest a good fit, but when fit indices fall in "marginal" ranges, it is especially important to consider other fit indices. This study attempted to obtain a RMSEA value below .08, as low as possible.

Root mean square residual (SRMR). SRMR is "the average discrepancy between the correlations observed in the input matrix and the correlations predicted by the model" (Brown, 2006, p. 82). It is preferred over root mean residual (RMR), which indicates the average discrepancy between observed and predicted covariances. For this reason, it is suggested to use root mean square residual (SRMR). SRMR takes values between 0.0 and 1.0, with 0.0 indicating perfect fit (the smaller the SRMR, the better the model fit). For good fit to the data, Brown (2006) suggests a value of .08 and below, and Hu and Bentler (1999) recommend a criterion of .06 and below. The root mean square residual (RMR) represents the average residual value derived from the fitting of the variance-covariance matrix for the hypothesized model to the variance-covariance matrix of the sample data. However, because these residuals are relative to the sizes of the observed variances and covariances, they are difficult to interpret. Thus, they are best interpreted in the metric of the correlation matrix (Hu & Bentler, 1999). The standardized RMR, then, represents the average value across all standardized residuals, and ranges from zero to 1.00; in a well-fitting model this value will be small (say .05 or less). This study attempted to obtain a SMRM below .06.

Modification indices. Modification indices give an approximation of how much the overall model chi-square would decrease if the fixed or constrained parameter were freely estimated (p. 119). Modification indices of 3.84 or greater (this is the value of Chi-square at $p<.05$ and 1 *df*, and this value is often rounded to 4.00) show that the model could be significantly improved ($p<.05$). Several high-modification indices may be remedied by freeing a single parameter, and the advice is to base freeing the parameters on prior research and theory. Additionally, modification indices are found to be sensitive to sample size, and there is a possibility to encounter borderline modification indices (e.g., larger than 3.84) with large

samples. If errors of the indicators X^1 and X^2 and of indicators X^2 and X^3 are correlated, then errors of X^1 and X^3 are also correlated. This means that the optimal solution should be chosen for freeing all three parameters. The pattern of modification indices and standardized residuals may also suggest the existence of a distinct factor (Brown, 2006). In those instances when two standardized residuals showed high covariance, a statistical approach was used. The total covariance of each of the standardized residuals within the model was calculated, and if the differences between the two covariances were large, the indicator whose standardized residual showed a large covariance was eliminated from the model. If the difference between the covariances of the standardized residuals of the two indicators did not seem large, the content represented by the indicators was taken into consideration.

Standardized residual covariances matrix. This matrix "reflects the difference between sample and model implied matrices (i.e. residual matrix = S – Σ) (Brown, 2006, p. 115). In general terms, standardized residuals that are equal or greater than the absolute value of 1.96 (z score at p<.05) are thought to be of concern. This value is often rounded to 2.00. However, standardized residuals are sensitive to sample size, and with large samples larger cutoff values are suggested (e.g., 2.58). So, the general guidelines for cutoff are suggested to be 2.00 to 2.58. In other words, these values show the number of standard deviations by which the residuals differ from the zero-value residuals that would be associated with a perfectly fitting model (Brown, 2006, p. 118). This study attempted to obtain standardized covariances below 2.58. Table 3.3 below lists the indices selected for reporting in the study together with their level of acceptable fit.

Table 3.3

Selected Indexes for CFA and SEM

Index	Shorthand	Acceptable fit
Absolute/predictive fit		
Chi-square	χ2	Smaller the better (sensitive to sample size)
Ratio of χ2 to df	CMIN/DF	5 or below given the sample size
Akaike information criterion	AIC	Smaller the better
Comparative fit		
Tucker-Lewis index	TLI	$\geq$ .95 for acceptance
Comparative fit index	CFI	$\geq$ .95 for acceptance
Parsimonious fit		
Parsimony-adjusted GFI	PGFI	Closer to 1 the better (can be lower than other indexes and sensitive to model size)
Other		
Root mean square error of approximation	RMSEA	smaller, the better, 0 will indicate perfect fit
Standardized RMR	SRMR	$\leq$ .08

Summary

This chapter discussed the research design and the research context. It provided

information on the sampling procedures and described the participants in the study. It defined the

variables in the study and discussed the selected measures. Additionally, it provided information

about the analysis and on the criteria that the study used for evaluating model fit. In the next

chapter the results of the study are presented.

CHAPTER 4: RESULTS

This study was designed to answer the question, Which factors contribute to knowledge sharing in virtual learning teams (VLTs)? The previous chapter described the research design, the research context, population and sample, and the variables and their corresponding measures, and it provided information about types of analyses used. This chapter describes the actual sample and the data handling procedures. Then it describes knowledge sharing in VLTs and reports on the regression analysis of key variables on knowledge sharing. Further, the chapter reports on the results of factor analysis on subconstructs, and presents the knowledge sharing measurement and structural models. The results of the analysis and the validation of the knowledge sharing structural model with multiple groups are also provided. The chapter concludes with discussion of findings and a summary.

Actual Sample

A total of 1,374 students responded to the survey. The numbers of participants by area of study were as follows- business: 311; computer and information technology: 155; education: 367; law: 170; health and nursing: 206. A few students, by personal choice, identified their area of study as engineering (1), arts and humanities (8), public affairs (7), science (11), and other (127), most likely referring to their previous areas of study, because the majors they identified did not always correspond with ones listed. Table 4.1 below presents the total sample (N = 1,374) by gender, ethnicity, age, academic level, and area of study.

Table 4.1

Sample Characteristics

Sample characteristics		N of Subjects	Percent
Gender	Female (1)	983	71.50
	Male (2)	377	27.40
	Missing	14	1.00
Age	Under 21 (1)	3	2.00
	21-23 (2)	25	1.80
	24–34 (3)	392	28.50
	35–44 (4)	465	33.80
	45–54 (5)	350	25.50
	55–64 (6)	116	8.40
	65 and over (7)	10	7.00
	Missing	13	0.90
Ethnicity	American Indian of Alaska Native (1)	16	1.20
	Asian (e.g., Indian, South Eastern Asian) (2)	29	2.10
	Black or African American (3)	239	17.40
	Hispanic/Latino (4)	88	6.40
	Native Hawaiian or Pacific Islander (5)	11	8.00
	White (Non-Hispanic) (6)	946	68.60
	Missing	45	3.30
Academic level	Undergraduate (1)	624	45.40
	Graduate (2)	648	47.20
	Missing	102	7.40
Area of study	Arts and humanities (1)	8	0.60
	Business (2)	311	22.60
	Computer and IT (3)	155	11.30
	Education (4)	367	26.70
	Engineering (5)	1	0.10
	Health and nursing (6)	206	15.00
	Law (7)	170	12.40
	Public affairs (9)	7	0.50
	Science (10)	11	0.80
	Missing	138	10.00

As Table 4.1 above suggests, higher percentage of the participants in the study were females (71.5%), ages 35 to 44 (33.8%), and White (non-Hispanic) (68.6%). Most were at the graduate level (47.2%) and majoring in education (26.6%). As stated earlier in the paper, the study also gathered information on some additional variables such as number of VLTs worked with, course level of recent VLT, technology skills, access to VLT space, VLT access limit, interaction hours per week, team assignment, VLT composition, and face-to-face meetings. Table 4.2 presents the total sample of N = 1,374 against those criteria.

Table 4.2.

Additional Information on Samples

Additional information		N of Subjects	Percent
Number of VLTs worked with	N/A	23	1.70
	1	47	3.40
	2	52	3.80
	4	1207	87.80
	Missing	45	3.30
Course level of recent VLT	Undergraduate (1)	655	47.70
	Graduate (2)	686	49.90
	Missing		
Technology skills	Extremely nonconversant (1)	4	0.30
	Below average (2)	16	1.20
	Average (3)	385	28.00
	Above average (4)	560	40.80
	Extremely conversant (5)	401	29.20
	Missing	33	2.40
Access to VLT space	Home computer(1)	653	47.50
	Work computer (2)	10	0.70
	iPhone/iPad (3)	8	0.60
	1 and 2 (4)	369	26.90
	2 and 3 (5)	15	1.10

	1 and 2 and 3 (6)	311	22.60
	Missing	8	0.60
VLT access limit	Strictly limited (1)	12	0.90
	Somewhat limited (2)	223	16.20
	Unlimited (3)	1128	82.10
	Missing	11	0.80
Interaction hours per week	Under 3 (1)	267	19.40
	3–5 (2)	504	36.70
	5-7 (3)	352	25.60
	7+ (4)	243	17.70
	Missing	8	0.60
Team assignment	Instructor assigned (1)	1228	89.40
	Self-selected (2)	133	9.70
	Missing	138	10.00
VLT composition	Males only (1)	38	2.80
	More males than females (2)	147	10.70
	Equal number of males and females (3)	278	20.20
	More females than males (4)	612	44.50
	Females only (5)	292	21.30
	Missing	7	0.50
Face-to-face meetings	No (0)	1332	96.90
	Yes (1)	37	2.80
	Missing	5	0.40

Table 4.2 suggests that higher percentage of the participants had experience working with more than four VLTs (N = 1207, 87.9%). Their most recent VLT was in a graduate level course (N = 686, 49%). The level of their technical skills was above average (N = 560, 40.8%). They accessed their VLT space from their home computer (N = 653, 47.5%). They had unlimited access to their VLT space given the cost of access, proximity of logon, locations and availability of access, and so on (N = 1128, 82.1%). They spent from three to five hours per week interacting with fellow VLT members (N = 504, 36.7%). Their most recent VLT was instructor assigned (N

= 1228, 89.4%). Their most recent VLT was comprised of only females (N = 292, 21.3%). They did not have face-to-face meetings with fellow VLT members (N = 1,332, 96.9%).

The total sample size in this study (N = 1,374) and the total sample size after data cleaning (N = 1,355) exceeded the sample sizes (a range of 51 to 547) reported by Russell (2000) that were used between 1998 and 2000 for confirmatory factor analysis. The actual sample size also met the sample size requirement set in the SEM literature, that is, 10 subjects per indicator. The total number of indicators on the different scales in the study is 132, and both N = 1,374 and N = 1,355 meet the requirement of a 1:10 ratio. However, the subconstructs in the study were analyzed individually, and the structural equation model was analyzed as a latent variable model with summed scores, which minimized the number of indicators.

Data Cleaning and Preparation

Participation eligibility. Experience with at least one VLT prior to completing the survey was one of the stated criteria for eligibility to participate in the study. For this reason, as the first step VLT number (VLTNum) was analyzed to obtain this information. VLTNum is a general item that was presented in the following way: "How many Virtual Learning Teams (VLTs) have you joined previously in online courses? (If your response is '0' you are done with the survey. Thank you for your time! Otherwise please continue)." The responses revealed that 23 cases (1.6%) did not have prior VLT experience (VLTNum = 0). Although these cases did not meet the eligibility criteria for participating in the study, they were not eliminated from the study based on the assumption that they might have had prior experience with VLTs elsewhere, for which reason they chose to continue participating in the study. It was beyond the scope of the study to gather information about the experiences of participants with virtual (learning) teams outside the university. Even if this assumption was not correct, 1.6% is a small number to be

concerned about. Forty-five cases (3.3%) did not respond to the item VLTNum. These cases also have not been eliminated from the study assuming that some learners might not have had too much experience with completing surveys and might fail to realize that it is important to answer all the questions on the survey.

Screening for missingness in dataset. A sample size of N = 1,374 is expected to produce 181,368 data points on a 132-item scale (product of N and number of variables or 1,374 * 132). A case summary shows that the dataset has 2,006 (1.11%) data points missing. Tabachnik and Fidel (2007) suggest that, if only a few data points (less than 5%) are missing in a random pattern from a large dataset, the problem is not serious. So, the identified missingness partially met this criterion (partially because as discussed later the missingness was not found to be random).

Screening for case-based missingness. An analysis of case-based missingness revealed that cases 180, 309, 615, 724, 1187, and 1,294 had missingness ranging from 62 to 130 on the total scale. These cases were eliminated from the study. This step decreased the sample size by six (N = 1,368). Missingness on the total scale for the rest of the cases ranged from 0 to 23 (17.42% maximum). For these cases data were imputed.

Screening for variable-based missingness. Missing values on individual variables ranged from 0.1% to 3.3%. These numbers also did not seem to be of much concern.

Screening for random missingness. The literature discusses missingness as data missing completely at random (MCAR), missing at random (MAR), and missing not at random (MNAR) (Fielding, Fayers, McDonald, McPherson, & Campbell for the RECORD study group, 2008). In order to diagnose the type of missingness, Little's MCAR test was run. For the missingness to be

at random the Chi-Square test should be non-significant. The test suggested that missingness was not at random (Chi Square = 37989.807, DF = 36427, Sig. = .000).

Imputing data. Different techniques have been suggested for imputing missing values, such as prior knowledge, mean substitution, expectation maximization (EM), and so on, all of which have their advantages and disadvantages. For instance, if prior knowledge is used, the researcher replaces missing values by educated guesses. This technique seems to be appropriate for longitudinal data. Mean substitution is a conservative technique. It does not change the mean of the distribution as a whole, and the researcher does not need to make guesses. The disadvantage of this technique is that the variance of the variable is reduced because the mean is closer to itself than to the missing value that it replaces. The correlation that the variable has with other variables is reduced because of the reduction of variance. Expectation minimization (EM) is discussed to be appropriate for randomly missing data. EM forms a missing data correlation (or covariance) matrix by assuming the shape of a distribution (such as normal) for the partially missing data and by basing inferences about missing values on the likelihood under that distribution. The disadvantages of the method are seen in the analysis bias because error is not added to the imputed data set (Tabachnik & Fiedel, 2007). Reviewing the literature on factor analysis, Rusell (2002) notes that the EM algorithm is a more accurate estimate of model parameters than methods that use likewise deletion. Many studies have used EM. This study also used EM to impute missing data before entering the scales into analysis.

Dealing with univariate and multivariate normality. Outliers can cause problems in any research because they can alter the outcome and violate normality in the data. Outliers have been discussed as univariate (created by cases on one variable), and multivariate (created by cases on more than one variable). Field (2007) notes that SPSS does not test the assumption of

multivariate normality and that the best thing to do is check the assumption of univariate normality for individual variables. Tabachnick and Fidel (2007) discuss four reasons for outliers to occur: (a) incorrect data entry; (b) failure to indicate missing value codes in computer syntax so that missing-value indicators are read as real data; (c) the outlier is not a member of population you intended to sample, (d) the case is from the intended population but the distribution for the variable in the population has more extreme values than a normal distribution (when this happens the case is retained but the researcher changes the value of the variable or variables). In this study, incorrect data entry cannot be a reason for missingness, because the study used an electronic questionnaire, which excluded mechanical errors in data tabulation. Though it was difficult to identify which of the other three reasons counted for the outliers, different methods for eliminating the outliers have been employed to choose the best method.

The literature suggests a number of methods for dealing with outliers: (a) boxplots, (b) using 10% trimmed means; (c) using windsorized samples (Howell, 2010), and (c) using transformations (Field, 2007; Burdenski, 2000), (d) using skewness and kurtosis; (e) using z-scores; (f) using mahalanobis distance at p<.001; and (d) using mardia's coefficient (Tabachnik & Fidel, 2007; Field, 2007). Values of skewness and kurtosis acceptable for psychometric purposes are said to be from +/-1 to +/-2. Values with z-scores beyond $\pm$3.29 are considered outliers, although in a large dataset a few values beyond the cutoff can also be found (Tabachnick & Fidel, 2007).

Boxplots have been used to detect the univariate outliers. Deleting outliers using boxplots did not work because it decreased the sample size from N = 1,374 to N = 820, and even after this, outliers still could be detected. The exploration of individual indicators showed some strange distributions on some. Three out of 132 indicators, namely Cooperation 1, Cooperation 4,

and Creativity 1 on the competency scale, showed distribution of the data similar to the one presented in Figure 4.1 below.
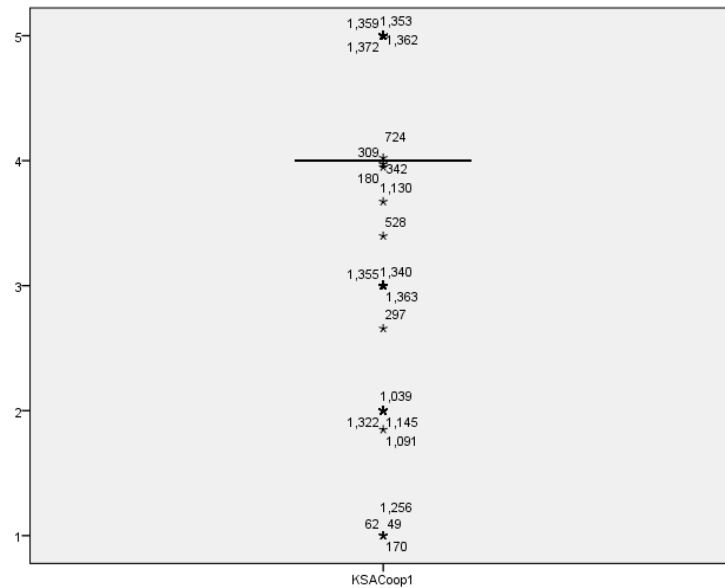
Figure 4.1: Boxplot of Cooperation 1 (KSACoop1)

A possible reason for this distribution could be the item design, which is a psychometric issue. The data on these three indicators do not have enough variance for analysis. The factor Cooperation has four indicators loading. Though this type of distribution on the above-mentioned indicators did not create difficulty for the analysis because the factors Cooperation and Creativity were analyzed as summed score variables, their presence on the scale narrows the scope of the construct, because the variance of only the remaining indicators can be analyzed.

Using windsorized samples or transformations also did not satisfy the researcher because an assumption was made that they would contribute to creating an artificial dataset. This study used mahalanobis distance to deal with univariate outliers and skewness and kurtosis was used to look at the distributions on individual variables.

Mahalanobis distance is evaluated as χ^2 with degrees of freedom equal to the number of variables (Tabachnik & Fidel, 2007). While IBM@SPSS® Amos(TM) 19 does present tables with mahalanobis distance and mardia's coefficient, AMOS HELP states that the tables it presents are of limited use because, though they do show departure from normality in the sample and provide a rough test of whether the departure is statistically significant, this is not enough. In order to make use of this information it is necessary to know how robust the chosen estimation method is against the departure from normality that has been discovered.

Additionally, the departure from normality that is big enough to be significant can still be small enough to be harmless (Assessment of Normality: IBM@SPSS® Amos[TM] 19). Another interesting idea about dealing with multivariate normality is the following. Kline (1998) notes that in simulation studies, even when data are severely non-normal, SEM parameter estimates (i.e., path estimates) are still fairly accurate, though their corresponding significance coefficients can be rather high. Lack of multivariate normality can inflate chi-square, which is also sensitive to sample size. Basing our judgment on the discussion above, the researcher decided to look at the distribution of data, its skewness and kurtosis, and at Mahalanobis distance to control for univariate normality. For a study with nine variables a Mahalanobis distance of below $\chi^2(9) =$ 27.88 can be a cutoff level. Thirteen cases with Mahal distance ranging from 27.92 to 108.52 were identified. These cases were eliminated, which decreased the sample size to 1,355. From this point on, "total sample" in this study refers to N = 1,355.

<div align="center">

Descriptive Statistics

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Before entering the data into different analyses, the researcher obtained a description of the data spread on different variables for the sample size of N = 1,355. Figure 4.2 presents the shapes of the distributions on the key variables in the study.
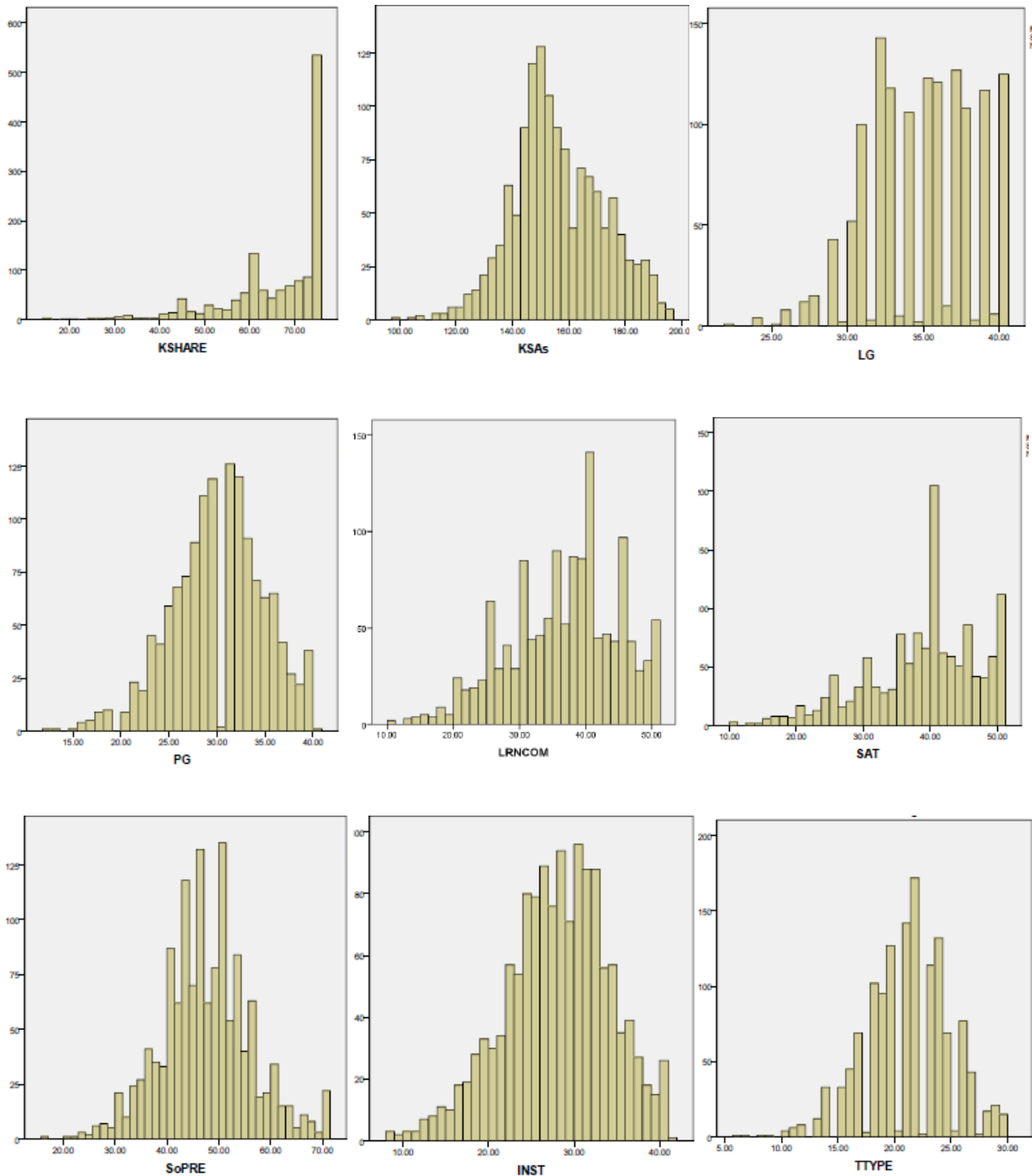
Figure 4.2. Distribution of data on observed variables (N = 1,355). The following abbreviations are used: LG = learning goal orientation, PG = performance goal orientation, KSAs = competencies for working on virtual learning teams, SAT = satisfaction with virtual learning team processes, LRNCOM = learning community, KSHARE = knowledge sharing, SOPRE = social presence, INST = instructor strategies, and TTYPE = task type.

From Figure 4.2 it is evident that the distribution of the data on different variables is different, which in turn results in difference in skewness and kurtosis. For instance, the distribution of data on knowledge sharing is negatively skewed whereas the distributions on KSAs or on INST look closer to normal.

Next, analysis of skewness and kurtosis was performed on the observed variables. Values of skewness and kurtosis that are acceptable for psychometric purposes are from +/-1 to +/-2 for large sample sizes.

Table 4.3

Skewness and Kurtosis Statistics for Observed Variables

Variables	Skewness	Kursosis
Learning goal orientation (LG)	-.316	-.523
Performance goal orientation (PG)	-.279	.050
Virtual learning team competencies (KSAs)	.107	-.159
Satisfaction with team processes (SAT)	-.711	.091
Learning community (LRNCOM)	-.417	-.374
Social presence (SOPRE)	.100	.345
Instructor strategies (INST)	-.332	-.024
Task type (TTYPE)	-.284	.218
Knowledge sharing (KSARE)	-1.388	1.812

As can be seen in Table 4.3, none of the values was found to be beyond the acceptable level of ±2.

Screening for colinearity. Colinearity is another concern in research. Perfect colinearity exists when "one predictor is a perfect linear combination of others. . . . [In this case] the correlation coefficient was 1.00. If there is perfect colinearity between predictors, it becomes impossible to obtain unique estimates of the regression coefficients because there are an infinite

number of combinations that would work equally well" (Field, 2009, p. 223). A correlation of

.90 or higher is considered to be a sign of colinearity (Tabachnik & Fidel, 2007). Colinearity can

be detected through correlation analysis. A correlation analysis was conducted on the variables

of interest.

Table 4.4

Means, STDs, Correlations

	Mean	STD	KS	LGO	PGO	KSAs	SAT	LRNCOM	SP	INST	TT
KSARE	34.85	10.92	1	.224**	.051	.338**	.313**	.325**	.231**	.181**	.212**
LG	30.85	3.44	.224**	1	.131**	.666**	.254**	.235**	.118**	.222**	.109**
PG	30.19	4.88	.051	.131**	1	.152**	.035	-.036	.082**	-.013	-.025
KSAs	156.24	16.1	.338**	.666**	.152**	1	.379**	.342**	.222**	.248**	.112**
SAT	38.53	8.27	.313**	.254**	.035	.379**	1	.877**	.416**	.484**	.025
LRNCOM	36.59	8.16	.325**	.235**	-.036	.342**	.877**	1	.348**	.504**	.121**
SOPRE	47.49	8.63	.231**	.118**	.082**	.222**	.416**	.348**	1	.237**	-.003
INST	27.56	6.11	.181**	.222**	-.013	.248**	.484**	.504**	.237**	1	.119**
TTYPE	21.2	3.81	.212**	.109**	-.025	.112**	.025	.121**	-.003	.119**	1

Note: N = 1,355. The following abbreviations are used: LG = learning goal orientation, PG = performance goal orientation, KSAs = competencies for working on virtual learning teams, SAT = satisfaction with virtual learning team processes, LRNCOM = learning community, KSHARE = knowledge sharing, SOPRE = social presence, INST = instructor strategies, and TTYPE = task type.

**. Correlation is significant at the 0.01 level (2-tailed).

The analysis detected a correlation of R = .877 between learning community (LRNCOM)

and satisfaction (SAT). If rounded, this number will equal .90. With a closer look at the scales of

LRNCOM and SAT, one can say that both scales measure students' satisfaction with different

aspects of their VLT involvement. SAT focuses on team processes, whereas LRNCOM measures

learners' expectation of support from the VLT for learning. Inferences made relate to learners'

satisfaction with their learning in VLTs. The high correlation between the two scales also was a

sign of redundancy of content. In order to identify the factors that had statistically significant

relationships with knowledge sharing, a multivariate regression analysis was performed, which is presented after knowledge sharing is described.

Description of knowledge sharing (KSHARE). Descriptive analysis of the data on knowledge sharing obtained from the total sample (N = 1,355) suggests the following picture: 33.9% of the participants reported that they "shared everything that they knew or had," 44.4 % reported that they "shared more than withheld," 16.5% reported that they "shared and withheld about equally," 4.4% reported that they withheld more than shared," and 0.8% of participants reported that they "withheld everything or nearly everything that I knew or had." Table 4.5 presents these numbers.

Table 4.5

Descriptive Analysis of Knowledge Sharing

	Frequency	Percent	Valid percent	Cumulative percent
1	11	0.8	0.8	0.8
2	58	4.3	4.3	5.1
3	224	16.5	16.5	21.6
4	602	44.4	44.4	66.1
5	460	33.9	33.9	100
Total	1,355	100	100	

Note: 5 = shared all knew or had; 4 = shared more than withheld;
3 = shared and withheld equally;2 = withheld more than shared;
1 = withheld all knew or had

Identifying Statistically Significant Predictors of Knowledge Sharing

A multiple regression analysis was performed with the total sample N = 1,355 to identify the key variables that are statistically significant predictors of knowledge sharing behavior in VLTs. Eight predictors (i.e. competencies for working in VLTs, learning goal orientation, performance goal orientation, learning community, social presence, task type and instructor

strategies) were regressed on knowledge sharing. The results of the analysis yielded R = .449, R^2 = .202, p <.001. To identify whether the multiple regression is statistically significant the omnibus *F* has been calculated through the formula: $F = (R^2/k)/[(1-R^2)/(N-k-1)]$, or $F =$ $(.449^2/8)/[(1-.449^2)(1355-8-1)] = 2.34$. The critical value of $F_{(8, 1346)}$ equals 2.53 at p= .01, which is higher than the calculated value of $F_{(8, 1346)}$, meaning that the regression is statistically significant.

Table 4.6 presents the results of the analysis.

Table 4.6

Multiple Regressions: Key Variables on Knowledge Sharing

	B	Std. Error	β	Sig.
(Constant)	15.218	3.508		0.000
LG	-0.026	0.104	-0.008	0.806
PG	0.037	0.056	0.016	0.512
KSAs	0.156	0.023	0.230	0.000
SAT	0.066	0.071	0.050	0.353
LRNCOM	0.212	0.071	0.158	0.003
SOPRE	0.139	0.034	0.110	0.000
INST	-0.044	0.051	-0.024	0.395
TTYPE	0.490	0.072	0.171	0.000

Note: R^2 = .202 (p < .001)

Only four out of the eight predictors showed statistically significant relationships with knowledge sharing (KSHARE). These variables are competencies (KSAs), social presence (SOPRE), learning community (LRNCOM), and task type (TTYPE). These variables were entered into confirmatory factor analysis to be discussed later in the paper. Meanwhile, the other four variables (learning goal orientation, performance goal orientation, satisfaction, and instructor strategies) were entered into multiple regression analysis with knowledge sharing,

again in the absence of the other four variables (competencies, learning community, social presence, and task type). The results of the analysis suggest that learning goal orientation (β=.15, p = .000), and satisfaction (β= .27, p= .000) have statistically significant positive relationships with knowledge sharing; whereas performance goal orientation (β= .02, p =.37) and instructor strategies (β= .92, p= .49) do not. This finding also means that learning goal orientation and satisfaction can be entered into another knowledge sharing model together. Next, the two remaining variables (i.e. instructor strategies and performance goal orientation) were entered into linear regression analysis individually. The results of the analysis suggested that instructor strategies (β = .18, p= .000) showed statistically significant predictive relationship with knowledge sharing , whereas performance goal orientation (β = .05, p = .06) did not.

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Construct Validation: Confirmatory Factor Analysis (CFA)

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Knowledge Sharing (KSHARE)

Model identification (sample A, N = 664). The 15-items scale of KSHARE is comprised of 14 adopted items presenting three distinct factors: Factor 1: sharing of task-related knowledge (6); Factor 2: sharing of team related knowledge (5); and Factor 3: sharing of environment-related knowledge (3) and one item added by the researcher. The model was entered into CFA as a second-order hierarchal model.

A CFA on the knowledge sharing three-factor 15-indicator initial model identified 120 distinct sample moments, 33 distinct parameters to be estimated, and 87 degrees of freedom. The general consensus is to use 10 participants per estimated parameter (Schreiber, 2006). The sample size of N = 664 meets and exceeds this requirement. The analysis of the initial model yielded the following results: $\chi^2(87) = 700.749$; CMIN/DF = 8.055; TLI = .935; CFI = .945;

PGFI = .636; RMSEA = .103; SRMR = .031; and AIC = 766.749. Figure 4.3 presents the

standardized solution of the knowledge sharing three-factor, 15-indicator initial model.

Figure 4.3. Standardized solution for the KSHARE initial model (G-KSHARE; F1-task knowledge; F2-team knowledge, F3-environment-related knowledge).

This model could not be accepted because RMSEA was .103, although all the values in

the standardized residuals matrix were below 1.96. The modification indices showed high

covariance between and among a number of variables. For instance, large covariance was

detected between the standardized residuals of KS1 and KS2 (176.63). The following principle

was used when decisions were made about which indicator to eliminate. When the standardized

residuals of two indicators showed high covariance, the researcher computed the total covariance

of each of them in the model, and the one with higher covariance was eliminated to lower the

Chi-square as much as possible, to arrive at a model fit with fewer steps if possible, and to preserve as many indicators as possible. When the total covariance of the standardized residuals of two indicators was almost equal in the model, the researcher looked at the amount and at the content that the indicators contributed to the construct.

The covariance of the standardized residual of KS1 in the model is 252.583. The covariance of KS2 in the model is 280.134.

KS1 <--> KS2. KS1 refers to the extent that learners shared their "general ideas on specific team tasks" with their team members. KS2 refers to the extent that learners shared their "knowledge of the relationships between various team task components." Both items showed approximately equal loading on the factor F1 (.83 and .85, respectively). It is assumed that VLT members would benefit more if they shared their knowledge of the relationships between various task components rather than sharing general ideas on specific team tasks. Though it was tempting not to eliminate KS2, assuming that the construct of knowledge sharing would be better presented by KS2 than by KS1, losing a chance of decreasing $\chi2$ by 27.55 if K2 were eliminated did not seem to be ideal. For this reason, KS2 was eliminated from the model.

The analysis of the KSHARE three-factor 14-indicator model (Alternative 1) yielded the following results: $\chi^2(74) = 424.427$; CMIN/DF = 5.736; TLI = .959; CFI = .966; PGFI = .646; RMSEA = .085; SRMR = .028; and AIC = 486.427. The next highest covariance was detected between the standardized residuals of KS9 and KS10 (48.928). KS9 and KS10 showed approximately equal covariance in the model, 128.895 and 122.496, respectively.

KS9 <--> KS10. KS9 refers to learners' sharing of their "understanding of team interaction patterns," and KS10 refers to learners' sharing of their "information about different team issues." KS9 showed higher loading (.87) than KS10 (.82). Additionally, "different team

issues" are somewhat general and most likely include team interaction patterns. The analysis was performed on the knowledge sharing three-factor 13-indicator model, interchangeably eliminating KS10 and KS9.

The analysis of the knowledge sharing three-factor 13-indicator model (Alternative 2a) with KS10 eliminated yielded the following results: $\chi^2(62)$ =320.360; CMIN/DF = 5.167; TLI = .966; CFI = .973; PGFI = .635; RMSEA = . 079; SRMR = .025; and AIC = 378.36. Repeating the analysis on the knowledge sharing three-factor 13-indicator model with KS9 eliminated (Alternative 2b) yielded the following results: $\chi^2(62)$ = 306.343; CMIN/DF = 4.941; TLI = .968; CFI = .974; PGFI = .636; RMSEA = .077; SRMR = .025; and AIC = 364.343. Though there was no change in the degrees of freedom, the value of χ^2 was lower when KS9 is eliminated. For this reason KS9 was eliminated from the model. The second model showed an acceptable CMIN/DF ratio, but RMSEA in both models was still high (.08). For this reason, the three-factor 13-indicator model could not be accepted yet. Another pair of indicators whose modification indices showed high covariance was KS5 and KS6. The standardized residual of KS5 showed a total covariance of 67.397 with the standardized residuals of a number of other indicators in the model and the standardized residual of KS6 showing a total covariance of 52.672 with the standardized residuals of other indicators in the model.

KS5 <--> KS6. KS5 relates to the sharing of one's "knowledge of specific strategies for completing various team tasks," and KS6 relates to one's "knowledge of general processes involved in conducting a given team task." KS5 and KS6 showed equal loading (.92) on the factor. It was assumed that, though many learners might have knowledge about general processes involved in conducting a given team task, the sharing of knowledge of specific strategies could benefit many. For this reason, KS5 was eliminated from the model.

Repeating the analysis on the KSHARE three-factor 12-indicator model (Alternative 3a) after eliminating KS5 yielded the following results: $\chi^2(51) = 238.035$; CMIN/DF = 4.667; TLI = .971; CFI = .978; PGFI = .617; RMSEA = .074; SRMR = .024; and AIC = 292.035. Analyzing the three-factor 12-indicator model after eliminating KS6 (Alternative 3b) yielded the following results: $\chi^2(51) = 215.957$; CMIN/DF = 4.234; TLI = .974; CFI = .980; PGFI = .619; RMSEA = .070; SRMR = .024; and AIC = 269.957. All the paths in the model were significant. This model showed an adequate fit to the data and was accepted.
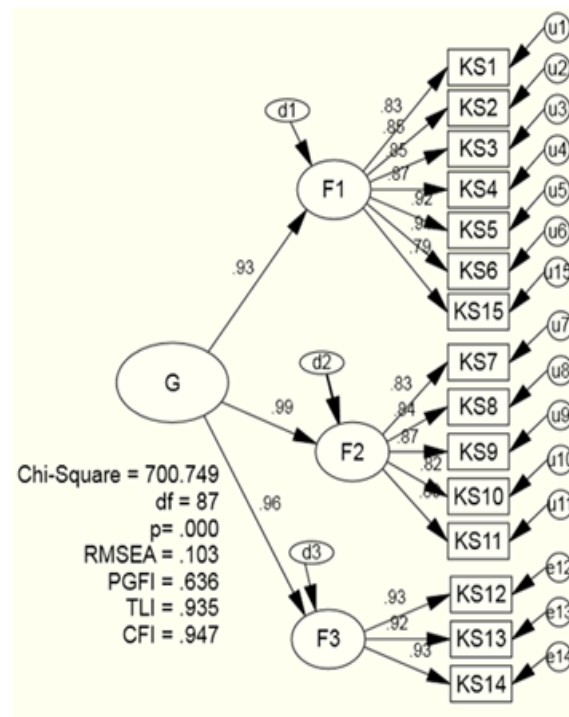

Figure 4.4. Standardized solution for KSHARE alternative model 1 (G-KSHARE; F1-task knowledge; F2-team knowledge, F3-environment-related knowledge).

The identified model is superior to all the models tested because it has the lowest χ^2, and all the indices show a good fit. The standardized residual covariances matrix in Table 4.7 below shows the number of standard deviations of observed residuals from zero or residuals that should exist if the model fits perfectly. All the values in the standardized residual covariances matrix are below 2.58. Although the standardized residuals are sensitive to sample size and one can expect

to see higher values in the residuals matrix when the sample size is large (Brown, 2006), the obtained results confirm that the model is a good fit to the data.

Table 4.7

Standardized Residual Covariances Matrix for KSHARE 12-Indicator Model

	KS11	KS10	KS8	KS7	KS15	KS5	KS4	KS3	KS1	KS14	KS13	KS12
KS11	0											
KS10	0.288	0										
KS8	-0.299	-0.447	0									
KS7	-0.369	0.419	0.887	0								
KS15	0.795	0.028	1.277	0.388	0							
KS5	-0.44	-0.639	0.558	0.514	-0.264	0						
KS4	-0.366	-0.351	0.151	0.434	-0.554	0.338	0					
KS3	-0.15	-0.816	0.973	0.315	-0.254	-0.09	-0.053	0				
KS1	-0.589	-1.846	0.442	0.476	0.038	-0.055	-0.229	0.943	0			
KS14	0.335	0.636	-0.107	-0.523	1.01	-0.281	0.072	-0.641	-0.381	0		
KS13	0.147	0.035	-0.688	-0.728	0.661	-0.397	0.211	-0.593	-0.097	0.143	0	
KS12	0.493	0.376	-0.497	-0.41	0.906	0.495	0.321	-0.7	-0.162	-0.162	0.046	0

Model reestimation (sample B, N = 691). The knowledge sharing model was re-estimated with Sample B (N = 691). The following results were obtained: $\chi^2(51) = 326.111$; CMIN/DF = 6.394; TLI = .960; CFI = .960; PGFI = .607; RMSEA = .088; SRMR = .023; and AIC = 380.111. The results of the analysis suggested that the model could not be accepted because RMSEA is equal to .09. The standardized residuals' matrix did not show any localized areas of concern. The three standardized values between KS11 and KS12 (1.137), KS12 and KS15 (1.746), and KS4 and KS10 (1.069) were below 1.96. However, modification indices did show that the standardized residuals of the three indicators have high covariance in the model. KS12—a covariance of 102.854, KS15—a covariance of 96.166, and KS11—a covariance of 79.714. KS12 is one of the three indicators on F3. For this reason, an attempt was made to eliminate indicators from other factors to avoid having a factor with only two indicators loading.

An attempt was made to eliminate KS15. KS15 refers to course-related information. Repeating the analysis on the knowledge sharing three-factor 11-item model (Alternative 1), the following results were obtained: $\chi^2(42) = 238.050$; CMIN/DF = 5.668; TLI = .969; CFI = .976; PGFI = .598; RMSEA = .082; SRMR = .021; AIC = 286.050. This model still had to be rejected. Next an attempt was made to analyze the model eliminating KS10. The analysis on the knowledge sharing three-factor 11-item model (Alternative 2) revealed negative variance on d2 (-.006). This parameter was fixed to 0. Repeating the analysis on the model, the following results were obtained: $\chi^2(42) = 273.924$; CMIN/DF = 6.522; TLI = .963; CFI = .972; PGFI = .595; RMSEA = .089; SRMR = .022; and AIC = 321.924. These results did not show a better fit either. The next analysis on the knowledge sharing three-factor 11- item model was performed after eliminating KS12. The analysis yielded the following results: $\chi^2(42) = 216.338$, CMIN/DF = 5.151, TLI = .971, CFI = .978, PGFI = .602, RMSEA = .078, SRMR = .021, AIC = 264.33. This model could not be accepted either because RMSEA was still high (.08), and CMIN/DF was slightly over 5. The modification indices, on the other hand, suggested that KS15 had considerably high covariance with three other indicators. Eliminating KS15 would have freed 6 parameters and would have decreased χ^2 by 64.734. Repeating the analysis on the knowledge sharing three-factor 10-indicator model with KS15 eliminated yielded the following results: $\chi^2(33) = 156.773$; CMIN/DF = 4.751; TLI = .976; CFI = .982; PGFI = .573; RMSEA = .074; SRMR = .019; AIC = 200.773. This model showed adequate fit to the data and was accepted. Figure 4.5 below presents the accepted model.
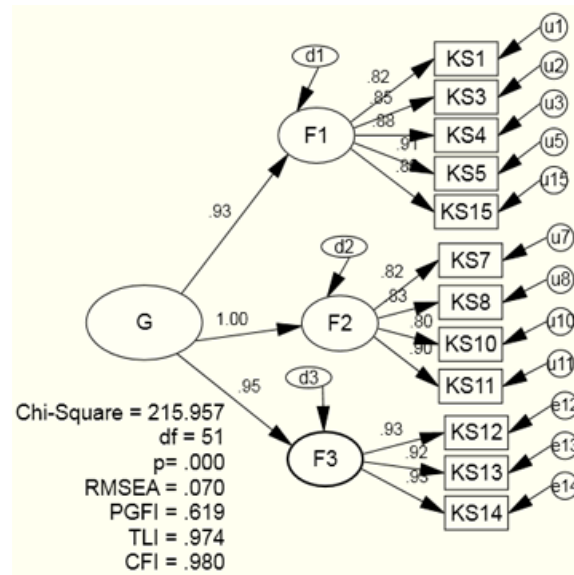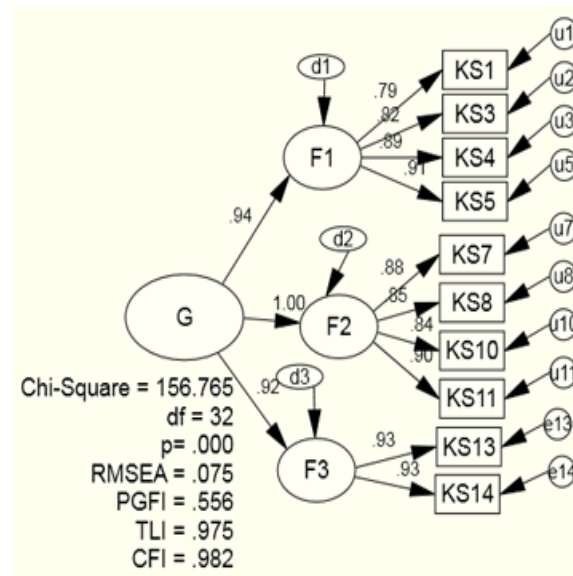
Figure 4.5. Standardized solution for KSHARE alternative model 2 (G-KSHARE; F1-task knowledge; F2-team knowledge, F3-environment-related knowledge).

Below is the standardized residual covariances matrix for the model, which confirms that the model should be accepted.

Table 4.8

Standardized Residual Covariances for the Identified KSHARE Model

	KS10	KS11	KS8	KS7	KS5	KS4	KS3	KS1	KS14	KS13
KS10	0									
KS11	0.128	0								
KS8	0.312	-0.302	0							
KS7	0.302	-0.45	0.517	0						
KS5	-0.392	0.089	0.432	0.738	0					
KS4	-1.357	-0.135	-0.736	0.237	0.307	0				
KS3	-0.062	0.52	0.283	0.037	-0.486	-0.206	0			
KS1	-1.159	0.056	-0.127	0.25	-0.546	0.321	0.973	0		
KS14	0.412	0.245	-0.07	-0.494	-0.264	-0.043	0.5	-0.05	0	
KS13	0.186	0.588	-0.51	-0.572	0.07	-0.029	0.059	0.186	0	0

Table 4.9 below presents the results of the analyses on the different models.

Table 4.9

KSHARE Model Analysis Results

	χ2	p	df	Δχ2	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial (3-factor, 15-indicator)	**700.75**	**0.000**	**87**		**0.94**	**0.95**	**0.64**	**0.10**	**0.03**	**766.75**
Alternative 1 (3-factor 14-indicator)	424.43	0.000	74	276.32	0.96	0.97	0.65	0.08	0.03	436.43
Alternative 2 a (3-factor 13-indicator)	320.36	0.000	62	104.07	0.97	0.97	0.64	0.08	0.03	378.36
Alternative 2b (3-factor , 13-indicator)	306.34	0.000	62	14.02	0.97	0.97	0.64	0.08	0.03	364.34
Alternative 3a (3-factor, 12-indicator)	238.04	0.000	51	68.30	0.97	0.98	0.62	0.07	0.02	292.04
Identified (3-factor, 12-indicator)	**215.96**	**0.000**	**51**	**22.08**	**0.97**	**0.98**	**0.62**	**0.07**	**0.02**	**269.96**
Reestimation (Sample B, 3-factor, 12-indicator)	326.11	0.000	51	- 110.15	0.96	0.96	0.61	0.09	0.02	380.11
Alternative 1 (3-factor, 11-indicator)	238.05	0.000	42	88.06	0.97	0.98	0.6	0.82	0.02	286.05
Alternative 1a (3-factor, 11-indicator)	273.92	0.000	42	52.19	0.96	0.97	0.6	0.09	0.02	321.92
Alternative 1b (3-factor, 11-indicator)	216.34	0.000	42	109.77	0.97	0.98	0.6	0.08	0.02	264.33
Identified (3-factor, 10-indicator)	**156.77**	**0.000**	**33**	**216.34**	**0.98**	**0.98**	**0.57**	**0.07**	**0.02**	**200.77**

Table 4.10 below shows the standardized total effects for the knowledge sharing

hierarchical model.

Table 4.10

KSHARE Model Total Effects (Standardized) for Hierarchical Model

	G	Teamwork (F2)	Task work (F1)	Environmental (F3)
Teamwork (F2)	1	0	0	0
Task work (F1)	0.942	0	0	0
Environmental (F3)	0.921	0	0	0
KS10	**0.836**	0.836	0	0
KS11	**0.904**	0.904	0	0
KS8	**0.847**	0.847	0	0
KS7	**0.880**	0.880	0	0
KS5	**0.860**	0	0.912	0
KS4	**0.835**	0	0.887	0
KS3	**0.769**	0	0.816	0
KS1	**0.749**	0	0.795	0
KS14	**0.858**	0	0	0.932
KS13[a]	**0.859**	0	0	0.933

[a]The lower portion of the first column shows the loading of the subsets on the hierarchical G variable.

All the indicators show rather high loading on the factors. The scale reliability analysis suggested a Chronbach's alpha of .96.

Competencies (KSAs)

Model identification (N = 664). The KSAs three-factor 11-indicator model was entered into CFA as a second-order hierarchal model. The analysis resulted in 66 distinct sample moments, 25 distinct parameters to be estimated, and 41 degrees of freedom. Additionally, the analysis yielded the following results $\chi^2(42) = 215.624$; CMIN/DF = 5.134; TLI = .929; CFI = .946; PGFI = .601; RMSEA = .079; SRMR = .042; and AIC = 263.624.
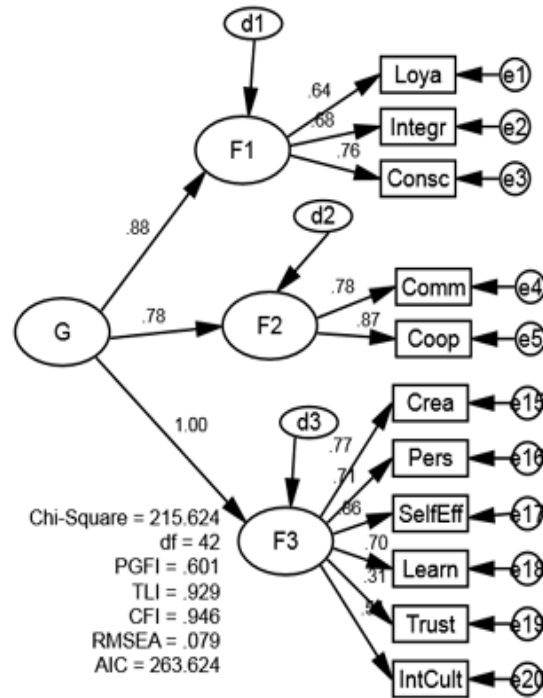
Figure 4.6. Standardized Solution for KSAs initial model (G-KSAs, F1-task work KSAs, F2-teamwork KSAs, F3-telecooperation KSAs)

This model did not show a good fit to the data and was rejected. The standardized residual covariances matrix showed three values between 2.661 and 4.172, higher than the cutoff level of 2.58. An analysis on the covariance of the standardized residuals of the indicators *Trust, Intercult, Learn,* and *Integr* in the model was conducted to identify the indicator, removing which χ^2 could be decreased the most. Total covariances of each of the four variables in the model were calculated. The highest covariance was identified with *Learn*. In other words, eliminating *Learn* would have decreased χ^2 by 97.677. *Learn* was eliminated from the model.

The high covariance of the standardized residual of *Learn* with the standardized residuals of other indicators in the model means that all of them together measure something else in common. Repeating the analysis on KSAs three-factor 10-indicator model (Alternative 1) suggested negative variance on the disturbance of factor 3 (d3 = -.112). The model solution was

inadmissible. This variance was fixed to zero. A repeated analysis produced the following

results: $\chi^2(33) = 117.947$; CMIN/DF = 3.572; TLI = .958; CFI = .692; PGFI = .579; RMSEA = .062; SRMR = .036; and AIC = 161.947.
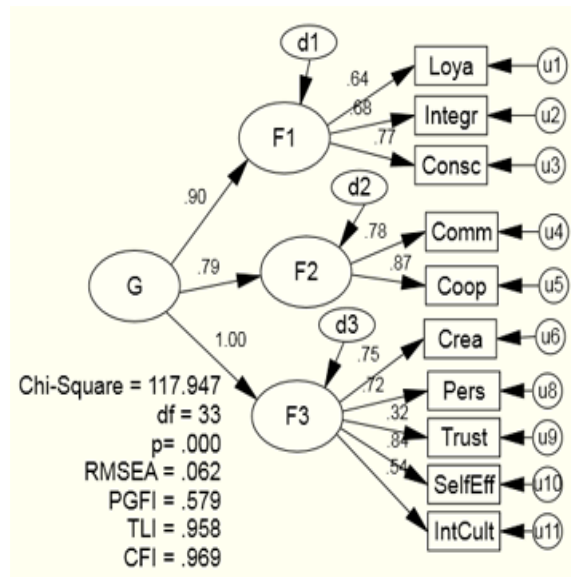
Figure 4.7. Standardized solution for KSAs alternative model 1 (G-KSAs, F1-task work KSAs, F2-teamwork KSAs, F3-telecooperation KSAs)

This model seemed to be a good fit to the data, except for the high covariances detected

between the standardized residuals of *Trust* and *Loyalty* (3.933) and the standardized residuals of

Trust and *IntCult* (2.518). An analysis of modification indices suggested that eliminating *Trust*

would decrease χ^2 by 45.545. *Trust* was eliminated from the model.

Repeating the analysis on the KSAs three-factor nine-indicator model yielded the

following results: $\chi^2(25) = 72.780$; CMIN/DF = 2.911; TLI = .974; CFI = .982; PGFI = .542;

RMSEA = .054; SRMR = .054, and AIC = 112.780. This model showed a good fit to the data

and was accepted.
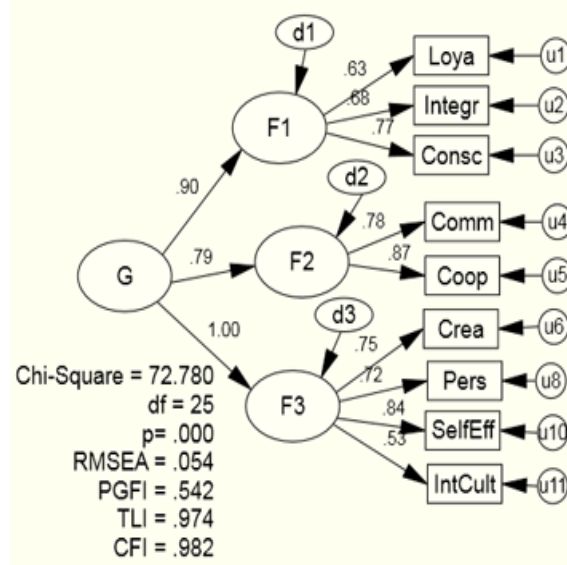
Figure 4.8. Standardized solution for KSAs alternative model 2 (F1-task work; KSAs, F2-teamwork; KSAs, F3-telecooperation KSAs, G-KSAs)

Model reestimation (sample B, N = 691). Analysis on the KSAs three-factor nine-indicator model yielded the following results: $\chi^2(25) = 123.954$; CMIN/DF = 4.958; TLI = .947; CFI = .963; PGFI = .533; RMSEA = .076; SRMR = .035; and AIC = 163.954. This model did not seem to be an acceptable fit. Modification indices suggest that the standardized residual of *IntCult* showed high covariance with the standardized residuals of some other indicators. *IntCult* also loaded lower (.55) than other indicators on the factor. This means that this indicator contributed less to the construct of telecooperation competencies in VLT individual members. *IntCult* was eliminated from the model. Repeating the analysis on the KSAs three-factor eight-indicator model, the researcher obtained the following results: $\chi^2(18) = 77.178$; CMIN/DF = 4.288; TLI = .962; CFI = .976; PGFI = .486; RMSEA = .069; SRMR = .030; and AIC = 113.178. This model showed a good fit to the data and was accepted. Figure 4.9 below presents the accepted model.
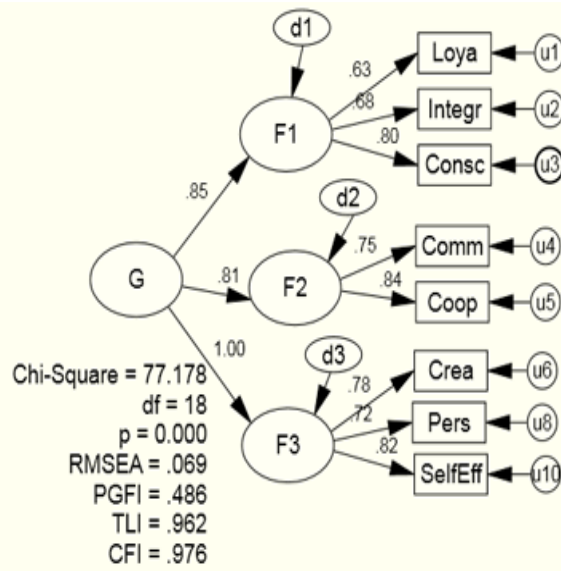
Figure 4.9. Standardized solution for KSAs alternative model 2 (F1-task work; KSAs, F2-teamwork; KSAs, F3-telecooperation, KSAs, G-KSAs)

Table 4.11 below presents the standardized residual covariances that confirm that the model is a good fit to the data.

Table 4.11

Standardized Residual Covariances Matrix for Identified KSAs Model

	SelfEff	Pers	Crea	Coop	Comm	Consc	Integr	Loya
SelfEff	0							
Pers	0.021	0						
Crea	0.338	-0.562	0					
Coop	-0.501	-0.333	0.558	0				
Comm	-0.086	-1.513	1.634	0	0			
Consc	0.569	1.601	-1.098	-0.450	-0.372	0		
Integr	-1.102	0.425	-1.050	0.969	-0.357	0.264	0	
Loya	-0.299	1.271	0.128	1.197	-0.642	-0.600	0.509	0

Table 4.12 below presents the results of the analyses on the different models of KSAs.

Table 4.12

Results of the Analysis on KSAs Models

	χ2	p	df	Δχ2	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial model (3-factor, 11-indicator)	**215.62**	**0.000**	**42**		**0.93**	**0.95**	**0.60**	**0.08**	**0.04**	**263.624**
Alternative 1 (3-factor, 10-indicator)	117.94	0.000	33	96.75	0.96	0.97	0.78	0.06	0.04	161.95
Identified model (3-factor, 9-indicator)	**72.78**	**0.000**	**25**	**45.16**	**0.97**	**9.98**	**0.54**	**0.05**	**0.03**	**112.78**
Reestimation (Sample B, 3-factor, 9 indicator)	123.95	0.000	25		0.95	0.96	0.54	0.08	0.35	163.95
Alternative 1 (3-factor, 8-indicator)	77.18	0.000	18		1	0.97	0.49	0.07	0.03	113.18

Other than looking at the different indices, the study also looked at the effects in the model. Table 4.13 below presents the standardized total effects in the KSAs model. It seems that the general variable of competencies is better presented by self-efficacy, persistence, and creativity (loadings .82, .72 and .78, respectively) than by the other five indicators, of which communication and cooperation (.61 and .68) showed somewhat higher loading than integrity (.58) and loyalty (.54). The three subconstructs that have not been confirmed in the competency model are: trust, learning motivation and intercultural communication. The reliability coefficient of the KSAs confirmed scale is .88.

Table 4.13

Standardized Total Effects for KSAs Hierarchical Model

	G	Telecooperation (F3)	Teamwork (F2)	Task work (F1)
Telecooperation (F3)	1	0	0	0
Teamwork (2)	0.815	0	0	0

Task work (1)	0.851	0	0	0
Self-efficacy	**0.818**	0.818	0	0
Persistence	**0.721**	0.721	0	0
Creativity	**0.782**	0.782	0	0
Cooperation	**0.682**	0	0.837	0
Communication	**0.611**	0	0.75	0
Conscientiousness	**0.680**	0	0	0.799
Integrity	**0.578**	0	0	0.679
Loyalty[a]	**0.539**	0	0	0.633

[a]The lower portion of the first column shows the loadings of the first order factors on the hierarchical VLT KSAs variable.

Social Presence (SOPRE)

Model identification (sample A, N = 664). The model of SOPRE was entered into CFA as a three-factor 14-item hierarchical model. The analysis suggested 10 distinct sample moments, 29 distinct parameters to be estimated, and 76 degrees of freedom. The results of the analysis also suggested that the variance of d2 was negative. Fixing this variance to 0, another negative variance was identified on d3. This variance was fixed to zero too. The analysis yielded the following results: $\chi^2(74)$ = 594.664; CMIN/DF = 7.951; TLI = .819; CFI = .849; PGFI = .640; RMSEA = .102; SRMR = .105; and AIC = 654.664.

Figure 4.10. Standardized solution for SOPRE initial model (G-SOPRE, F1-interactive responses; F2-cohesive responses; F3-affective responses)

The results of the analysis suggested that the model has to be rejected because RMSEA was higher than the acceptable level of .08. SP1 showed very low loading on F2 (.29) and was eliminated from the model. Repeating the analysis on the SOPRE three-factor 13-indicator model yielded the following results: $\chi^2(64) = 365.487$; CMIN/DF = 5.711; TLI = .884; CFI = .905; PGFI = .647; RMSEA = .084; SRMR = .071; and AIC = 419.487. Modification indices suggest that the standardized residual of SP7 had high covariance with the standardized residuals of a number of other indicators. SP7 was eliminated from the model. Repeating the analysis on the SOPRE three-factor 12-indicator model yielded the following results: $\chi^2(53) = 295.980$; CMIN/DF = 5.585; TLI = .899; CFI = .919; PGFI = .631; RMSEA = .083; SRMR = .067; and AIC = 345.980. Standardized residual covariance matrix suggests that SP8 is another indicator

whose standardized residual has high covariance with the standardized residuals of other indicators. SP8 was eliminated from the model. Repeating the analysis on the SOPRE three-factor 11-indicator model yielded the following results: $\chi^2(43) = 226.419$; CMIN/DF = 5.266; TLI = .917; CFI = .935; PGFI = .613; RMSEA = .080; SRMR = .059; and AIC = 272.419. The standardized residual covariances matrix suggested a covariance of 3.430 between the standardized residuals of SP6 and SP5. To decide on which indicator should be eliminated, the researcher calculated the total covariance of each indicator in the model. SP5 showed higher covariance in the model than SP6. For this reason, SP5 was eliminated from the model. Repeating the analysis on the SOPRE three factor 10-indicator model yielded the following results: $\chi^2(34) = 184.402$; CMIN/DF = 5.424; TLI = .922; CFI = .941; PGFI = .585; RMSEA = .082; SRMR = .057; and AIC = 226.402. This model still could not be accepted because RMSEA was equal to .08. Analysis on the covariance within the model suggested that if SP14 was eliminated, χ^2 would decrease by 97.835. For this reason, SP14 was eliminated from the model. Repeating the analysis on the SOPRE three-factor nine-indicator model yielded the following results: $\chi^2(26) = 94.794$; CMIN/DF = 3.646; TLI = .956; CFI = .968; PGFI = .560; RMSEA = .063; SRMR = .055; and AIC = 132.794. Judging from the modification indices, this model could be accepted as being a good fit to the data, but the standardized residual covariances matrix still showed that SP9 had high covariance, higher than the cutoff level of 2.58. SP9 was eliminated from the model. Repeating the analysis on the SOPRE yielded the following results: $\chi^2(19) = 37.514$; CMIN/DF = 1.974; TLI = .985; CFI = .990; PGFI = .520; RMSEA = .038; SRMR = .036; and AIC = 71.514. This model showed a good fit to the data and was accepted. All the values in the standardized residual covariances matrix confirmed that the social presence model should be accepted.
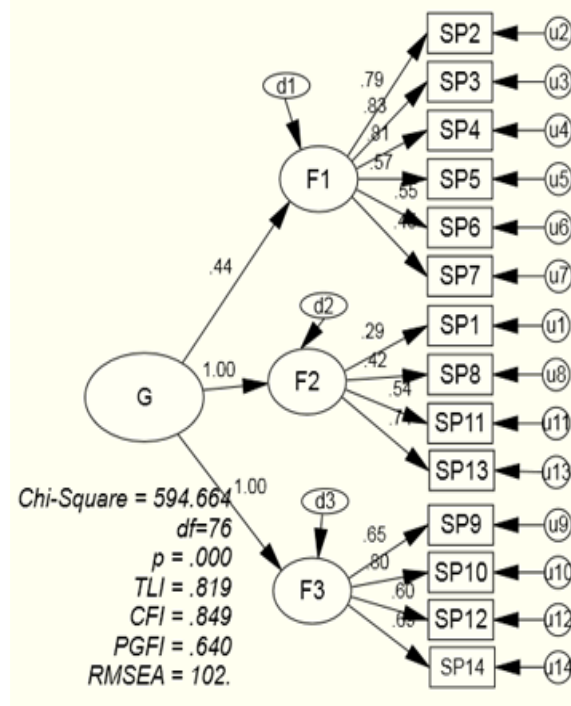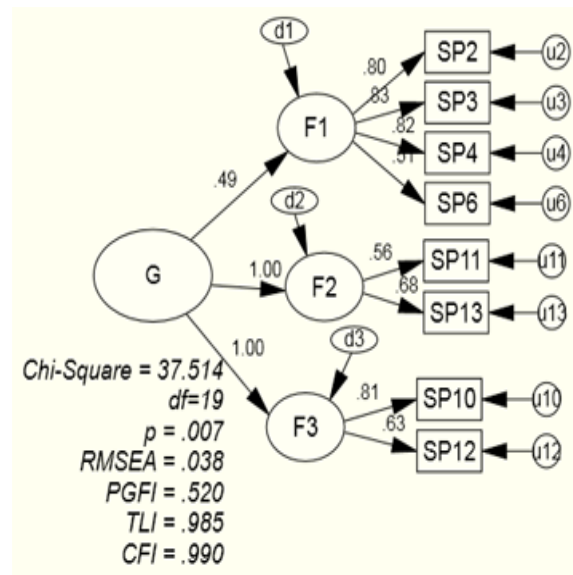
Figure 4.11. Standardized solution for SOPRE alternative model 1 (G-SOPRE, F1-interactive responses; F2-cohesive responses; F3-affective responses)

Table 4.14 below presents the standardized residual covariances for the social presence model. Although some of the values in the table are slightly above 2.0, for this sample size they seem to be appropriate because they are below the cutoff level of 2.58.

Table 4.14

Standardized Residual Covariances Matrix for Identified SOPRE Model

	SP13	SP11	SP12	SP10	SP6	SP4	SP3	SP2
SP13	0							
SP11	-0.1	0						
SP12	-0.215	0.094	0					
SP10	0.557	-0.238	-0.387	0				
SP6	-0.885	1.715	0.687	0.665	0			
SP4	-1.736	1.150	2.144	-0.466		0		
SP3	-2.109	1.134	1.344	-0.531	0.356	-0.012	0	
SP2	-1.228	0.213	2.207	0.181	-0.409	0.058	-0.009	0

Table 4.15 below suggests that the eight indicators explain the general social presence variable to different extents. The latent variable is best explained by SP10, while SP25 has a rather low explanatory power (.25). The low loadings and the fact that some indicators show loading ranging from .25 and below.50 creates some limitations for the subconstruct, although the model fit indices showed that the model is good fit to the data.

Table 4.15

Standardized Total Effects for the Presence Hierarchical Model

	G	Cohesive (F2)	Affective (F3)	Interactive (F1)
Cohesive (F2)	1	0	0	0
Affective (F3)	1	0	0	0
Interactive (F1)	0.486	0	0	0
SP13	0.683	0.683	0	0
SP11	0.561	0.561	0	0
SP12	0.629	0	0.629	0
SP10	0.806	0	0.806	0
SP6	0.250	0	0	0.514
SP4	0.397	0	0	0.817
SP3	0.402	0	0	0.826
SP2[a]	0.389	0	0	0.801

[a]The lower portion of the first column shows the loadings of the first order factors on the hierarchical SOPRE variable.

Model reestimation (sample B, N = 691). The analysis of the social presence three-factor eight-indicator model yielded the following results: $\chi^2(19) = 41.373$; CMIN/DF = 2.178; TLI = .983; CFI = .989; PGFI = .520; RMSEA = .041; SRMR= .030; and AIC = 75.373. The model showed a good fit to the data and had to be accepted. The scale reliability analysis suggested a Chronbach's alpha of .82.

Table 4.16 below presents the results of the CFA analysis of the social presence model.

Table 4.16

Results of the Analysis on SOPRE Models

	χ2	p	df	Δχ2	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial (Sample A, 3-factor, 14-indicator)	**594.66**	**0.000**	**76**		**0.82**	**0.85**	**0.64**	**0.10**	**0.11**	**654.66**
Alternative 1a (3-factor 13-indicator)	365.49	0.000	64	229.20	0.88	0.91	0.65	0.08	0.07	419.49
Alternative 2 (3-factor 12-indicator)	295.98	0.000	53	69.51	0.90	0.92	0.63	0.08	0.07	345.98
Alternative 2 (3-factor 11-indicator)	226.42	0.000	43	69.56	0.92	0.94	0.61	0.08	0.06	272.42
Alternative 3 (3-factor 10-indicator)	184.40	0.000	34	42.02	0.92	0.94	0.59	0.08	0.06	226.4
Alternative 4 (3-factor 9-indicator)	94.79	0.000	26	89.61	0.96	0.97	0.56	0.06	0.06	132.79
Identified (3-factor 8-indicator)	**37.51**	**0.007**	**19**	**57.28**	**0.99**	**0.99**	**0.52**	**0.04**	**0.04**	**71.51**
Reestimation (Sample B, 3-factor 8-indicator)	**41.37**	**0.002**	**19**	**-3.86**	**0.98**		**0.99**	**0.52**	**0.04**	**75.37**

Learning Community (LRNCOM)

Model identification (sample A, N = 664). A CFA on the LRNCOM one-factor 10-indicator model suggests 55 distinct sample moments, 20 distinct parameters to be estimated, and 35 degrees of freedom. Additionally, the analysis yielded the following results: $\chi^2(35) = 421.365$; CMIN/DF = 12.039; TLI = .863; CFI = .893; PGFI = .559; RMSEA = .129; SRMR = .071; and AIC = 461.365.
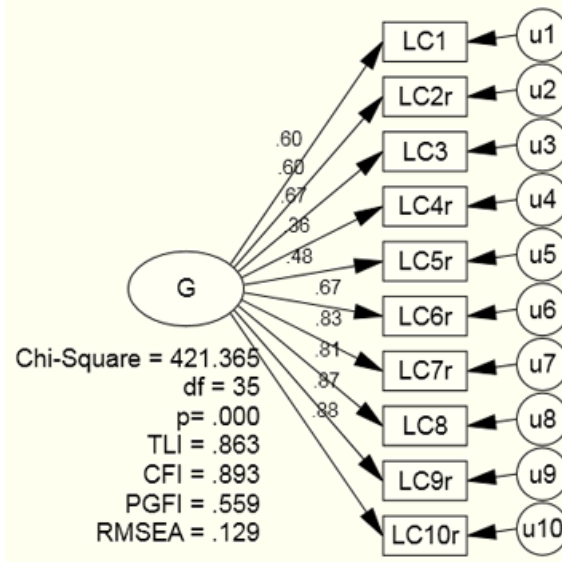
Figure 4.12. Standardized solution for LRNCOM initial model (G-LRNCOM)

Modification indices showed very high covariance between the standardized residuals of LC4r and LC5r (125.889). A closer look at the covariance within the model suggested that eliminating LC4r would decrease χ^2 by 206.412. LC4r was eliminated from the model. Repeating the analysis of the LRNCOM one-factor nine-indicator model yielded the following results:

$\chi^2(27) = 246.071$; CMIN/DF = 9.114; TLI = .913; CFI = .935; PGFI = .553; RMSEA = .111;

SRMR = .048; and AIC = 282.071. Modification indices showed that eliminating LC1 would decrease χ^2 by 109.39. Repeating the analysis on the LRNCOM one-factor eight-indicator model yielded the following results: $\chi^2(20) = 145.913$; CMIN/DF = 7.296; TLI = .941; CFI = .958;

PGFI = .525; RMSEA = .097; SRMR = .042; and AIC = 177.913. Another indicator whose standardized residual showed high covariance with the standardized residuals of other indicators was LC5r. Eliminating LC5r, χ^2 would have decreased by 71.408. LC5 was eliminated from the model. Repeating the analysis on the LRNCOM one-factor seven-indicator model yielded the following results: $\chi^2(14) = 87.791$; CMIN/DF = 6.271; TLI = .961; CFI = .974; PGFI = .482;

RMSEA = .089; SRMR = .031; and AIC = 115.791. This model still could not be accepted because RMSEA was high. The next indicator to be eliminated was LC9. Eliminating LC9 χ^2 decreased by 42.388. Repeating the analysis on the LRNCOM one-factor six-indicator model yielded the following results: $\chi^2(9) = 36.699$; CMIN/DF = 4.078; TLI = .976; CFI = .986; PGFI = .421; RMSEA = .068; SRMR = .025; and AIC = 60.699. This model showed an adequate fit to the data and was accepted.
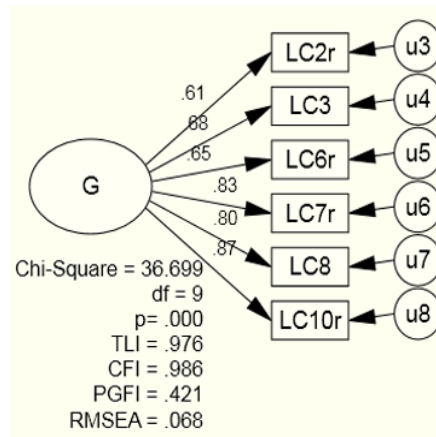
Figure 4.13. Standardized solution for LRNCOM alternative model 1 (G-LRNCOM)

Table 4.17 below presents standardized residual covariances matrix that confirms the model fit. All the values in the matrix meet the established criteria of below 2.58.

Table 4.17

Standardized Residual Covariances Matrix for Identified LRNCOM Model

	LC1 0r	LC8	LC7r	LC6r	LC3	LC2r
LC1 0r	0					
LC8	0.239	0				
LC7r	-0.162	0.064	0			
LC6r	-0.403	0.098	0.76	0		

LC3	0.253	0.121	-0.422	-1.236	0
LC2r	0.025	-1.416	0.14	0.804	1.442	0

Model reestimation (sample B, N = 691). The analysis on the LRNCOM one-factor six-indicator model yielded the following results: $\chi^2(9) = 62.661$, CMIN/DF = 6.962, TLI = .953, CFI = .972, PGFI = .416, RMSEA = .093, SRMR = .032, AIC = 86.661. This model had to be rejected because RMSEA was high. Analysis of modification indices suggests that eliminating LC3 would decrease χ^2 by 63.623. The standardized residual of LC6r showed high covariance with standardized residuals of LC2 and LC7r. Eliminating L6r χ^2 decreased by 41.675. Repeating the analysis on the LRNCOM one-factor five-indicator model yielded the following results: $\chi^2(5)$ = 24.33; CMIN/DF = 4.865; TLI = .975; CFI = .988; PGFI = .329; RMSEA = .075; SRMR = .021; and AIC = 44.326. This model showed a good fit to the data and was accepted. A scale reliability analysis yielded a Chronbach's alpha of .86.
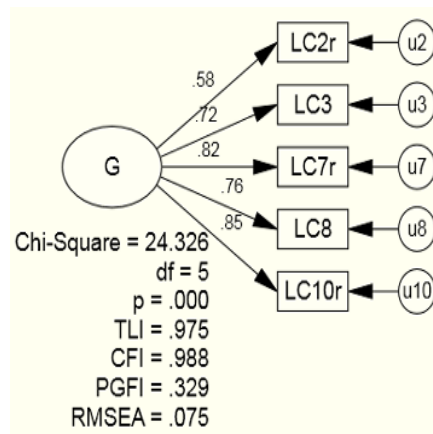
Figure 4.14. Standardized solution for LRNCOM alternative model 2 (G-LRNCOM)

Table 4.18 presents the results of the analysis on alternative models of collaborative environment.

Table 4.18

Standardized Residual Covariances Matrix for LRNCOM Reevaluated Model

	LC10r	LC8	LC7r	LC3	LC2r
LC10r	0				
LC8	-0.27	0			
LC7r	0.312	-0.099	0		
LC3	-0.054	1.154	-0.895	0	
LC2r	-0.284	-0.719	0.608	0.449	0

Table 4.19 below presents the analysis performed on the different models of LRNCOM.

Table 4.19

Results of the Analysis of LRNCOM Models

	χ^2	*p*	df	$\Delta\chi^2$	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial, Sample A, (1-factor, 10-indicator)	**421.37**	**0.000**	**35**		**0.86**	**0.89**	**0.56**	**0.13**	**0.07**	**461.4**
Alternative 1 (1-factor, 9-indicator)	246.07	0.000	27	175.3	0.92	0.94	0.55	0.11	0.05	232.07
Alternative 1 (1-factor, 8-indicator)	145.91	0.000	20	100.16	0.94	0.96	0.53	0.10	0.42	177.91
Alternative 1 (1-factor, 7-indicator)	87.79	0.000	14	58.12	0.96	0.97	0.48	0.90	0.31	115.79
Alternative 1-Identified (1-factor, 6-indicator)	**36.70**	**0.000**	**9**	**51.09**	**0.98**	**0.99**	**0.42**	**0.07**	**0.03**	**60.7**
Reestimation Sample B (1-factor, 6-indicator)	62.66	0.000	9	-25.96	6.96	0.95	0.97	0.93	0.32	86.66

Reestimation Alternative 1, Sample B, (1-factor, 8-indicator)	24.33	0.000	5	38.33	0.98	0.99	0.33	0.08	0.21	44.33

Task Type (TTYPE)

Model identification (sample A, N = 664). A CFA on the TTYPE one factor-six indicator model resulted in 21 distinct sample moments, 12 distinct parameters to be estimated, and 9 degrees of freedom. Additionally, analysis yielded the following results: $\chi^2(9) = 39.502$; CMIN/DF = 4.389; TLI = .910; CFI = .946; PGFI = .420; RMSEA = .071; SRMR = .040; AIC = 63.502.
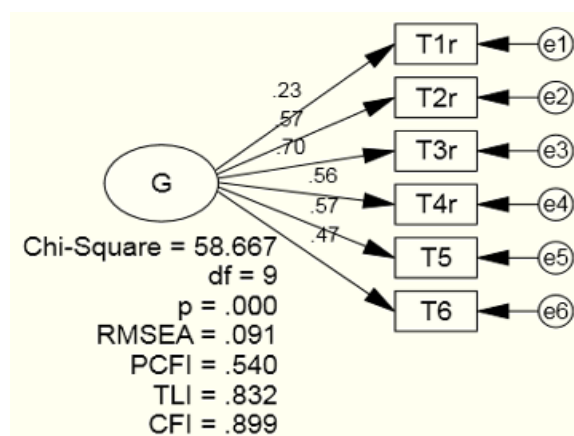
Figure 4.15. Standardized Solution for TTYPE initial model (G-TYYPE)

The analysis showed that TLI and CFI were somewhat low. The standardized residual of T6 showed high covariance in the model. T6 was eliminated from the model. Repeating the analysis on the TTYPE model yielded the following results: $\chi^2(5) = 9.780$; CMIN/DF = 1.956; TLI = .978; CFI = .989; PGFI = .331; RMSEA = .038; SRMR = .023; and AIC = 29.780. This model showed a good fit to the data and was accepted.
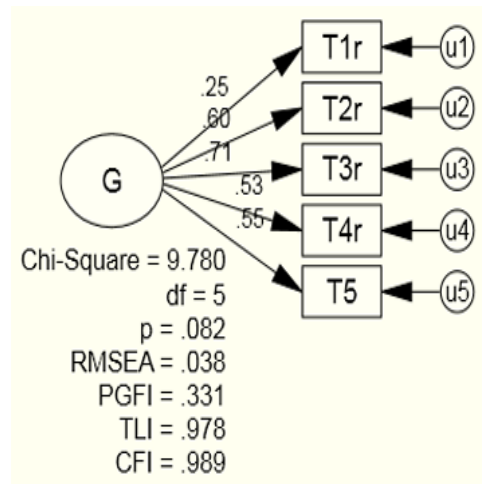
Figure 4.16. Standardized solution for TTYPE identified model (G-TTYPE)

As Figure 4.16 shows T1r has low loading on the factor (.25), which means that it does

not contribute to the factor of TTYPE much, but it has not been eliminated because the

CMIN/DF ratio everywhere is being described between 2:1 and 5:1 and not lower than 2:1, and

eliminating T1r a CMIN/DF ratio of 1.2: 1 would have been obtained.

Table 4.20 below presents the standardized residual covariances matrix for the task type

model.

Table 4.20

Standardized Residual Covariances Matrix for TTYPE Identified Model

	T6	T5	T4r	T3r	T2r	T1r
T6	0					
T5	1.228	0				
T4r	2.14	-0.613	0			
T3r	-0.48	-0.457	0.088	0		
T2r	-2.009	0.291	-0.862	0.841	0	
T1r	-1.976	0.797	-0.642	-0.478	2.030	0

Model reestimation (sample B, N = 691). The analysis on the TTYPE one-factor five-

indicator model yielded the following results: $\chi^2(5) = 13.552$; CMIN/DF = 2.710; TLI = .956;

CFI = .978; PGFI = .331; RMSEA = .050; SRMR = .026; and AIC = 33.552. The model tested

with Sample B also showed a good fit to the data. The scale reliability analysis on task type

yielded a Chronbach's alpha of .63.

Table 4.21 below presents the results of the analyses on the initial and alternative models

of task type.

Table 4.21

Results of Analysis on TTYPE Models

	χ2	p	df	Δχ2	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial (1-factor, 6-indicator)	39.50	0.000	9		0.91	0.95	0.42	0.07	0.04	63.5
Alternative-identified (1-factor, 5-indicator)	9.78	0.000	5	29.72	0.98	0.99	0.33	0.04	0.02	29.78
Reestimated (Sample B)	13.55	0.000	5	-3.77	0.96	0.98	0.33	0.05	0.03	33.55

CFA Validated Subconstructs

Table 4.22 below presents the CFA validated subconstructs that were entered into the

knowledge sharing measurement model.

Table 4.22

Subconstructs in VLT Knowledge Sharing Measurement Model

Latent variables	Factor and indicators
Knowledge sharing (KSHARE)	Factor 1: KS1-KS3, KS5; Factor 2: KS7, KS8, KS10, KS11; Factor 3: KS13, KS14
VLT competencies (KSAs)	Factor 1: loyalty (3), integrity (4), conscientiousness; Factor 2: communication (4), cooperation (4); Factor 3: creativity (4), persistence (3), self-efficacy
Social presence (SOPRE)	Factor 1: SP2-SP4, SP6; Factor 2: SP11, SP13; Factor 2: SP10, SP12
Learning Community (LRNCOM)	LC2r, LC3, LC7r , LC8, LC10r

Task type (TTYPE)   T1r –T5

Measurement Model

This part of the study presents latent variables SEM. Latent variables SEM "is a confirmatory factor analysis of the constructs involved in the research project, along with a path analysis of the effects of these constructs on each other" (Keith, 2006, p. 332). Latent variables SEM is comprised of two components: (a) a measurement model, and (b) a structural model (Mulaik & Millsap, 2000).

The variables are entered into the measurement model in the following way.

- Knowledge sharing (KSHARE): (a) TSK (task-related knowledge) (e.g.,"To what extent did you share your general ideas of specific team tasks?"), (b) TM (team-related knowledge) (e.g., "To what extent did you share your understanding of team member roles and responsibilities for doing various team tasks?), (c) ENV (environment-related knowledge) (e.g., "To what extent did you share you knowledge of environmental constraints when your VLT performed various tasks?").

- VLT competencies (KSAs): This construct relates to (a) task-related KSAs (these KSAs relate to individuals' loyalty to their teams, and their conscientiousness and integrity while working with their teams), (b) team-related KSAs (these KSAs relate to individuals' communication and cooperation skills within the VLTs), and (c) telecooperation-related KSAs (these KSAs relate to individuals' self-efficacy as well as their creativity and persistence in teamwork).

- Learning community (LRNCOM): This construct relates to the support and encouragement of learning in VLT (e.g., "I felt I was encouraged to ask questions in my VLT").

- Social presence (SOPRE): This construct relates to (a) INT (interactive responses) (e.g., VLT members "expressed appreciation for the contribution of another team member"), (b) COH (cohesive responses) (e.g., VLT members "referred to another member by name"), and (c) AFF (affective responses) (e.g., "My VLT members "wrote something humorous").

- Task type (TTYPE): This construct relates to interdependence in task coordination and performance (e.g., "Team tasks required frequent coordination with the efforts of others").
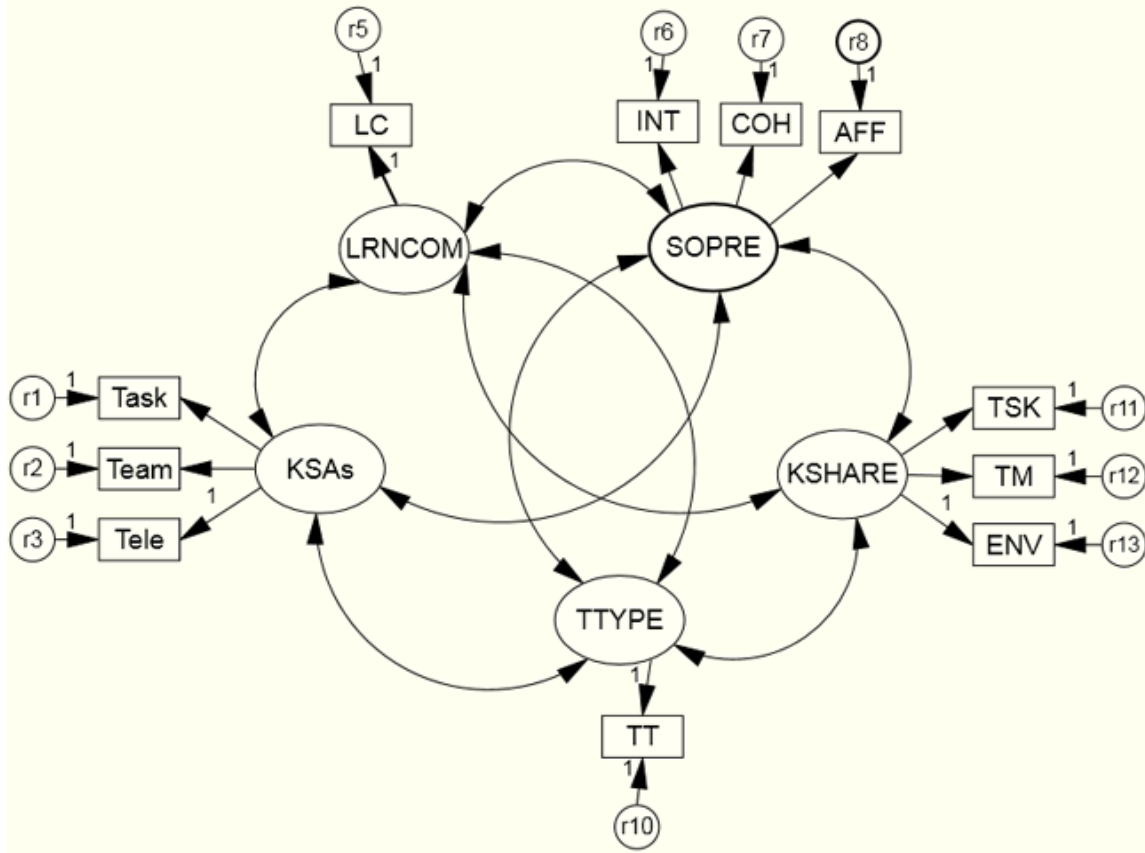
Figure 4.17. Knowledge sharing measurement model

Structural Model

Below is the VLT knowledge sharing structural model. This model has three latent variables with three manifest variables loading on them and two latent variables with a single indicator factor loading. Keith (2006) states that "a common method for dealing with single-indicator factors is to constrain the error-unique variance of that measured variable to some value, often a value of 1 minus the estimated reliability of the measured variable" (p. 353). The reliability coefficient for LRNCOM is Chronbach's alpha .86, and the reliability coefficient for task type is Chronbach's alpha .63. Thus, the unique variance for LRNCOM single indicator is

calculated as 1-.86 = .14, and the unique variance of TTYPE single indicator is calculated as 1-

.63 = .37. The structural model was analyzed with the total sample size of N = 1,355.
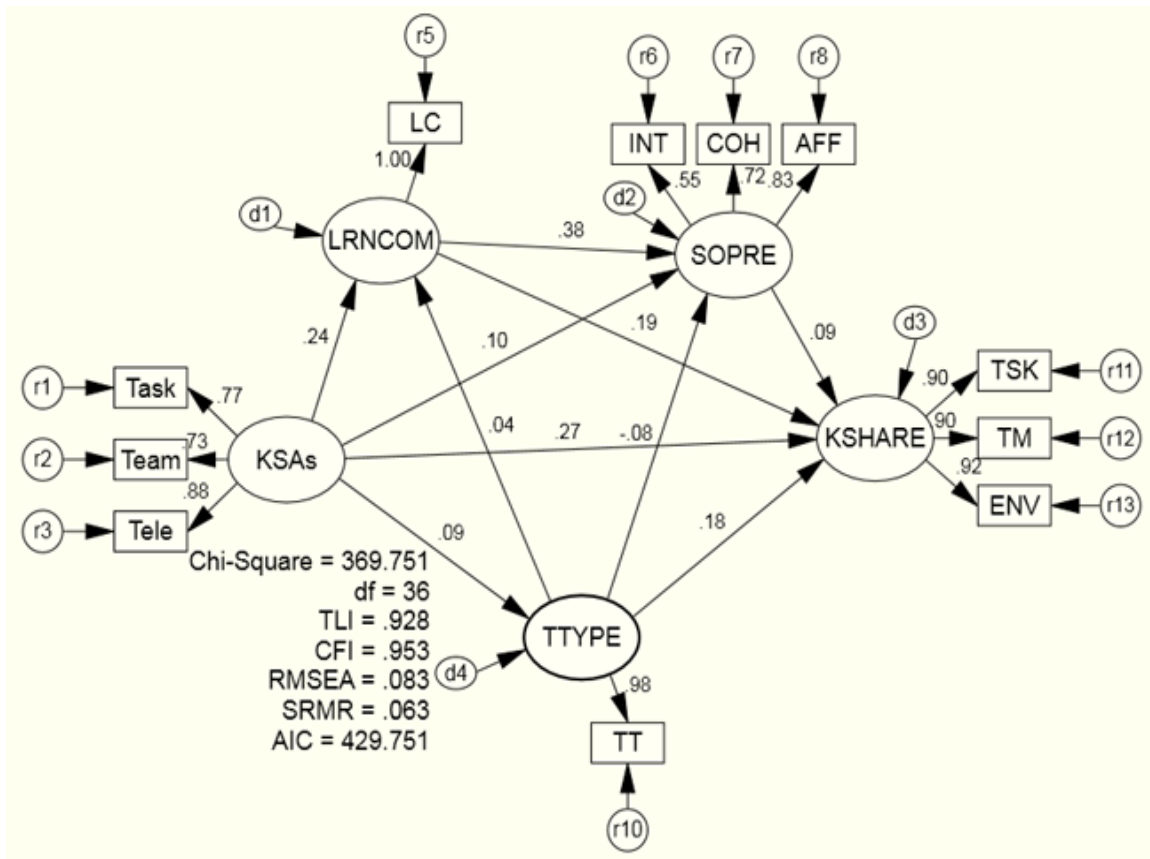
Figure 4.18. Standardized solution for knowledge sharing saturated model. The model is not a good fit for the data.

The structural model has nine paths. The results of the analysis suggest that the model is

not a good fit to the data. The analysis showed non-significant paths between LRNCOM and

TTYPE and SOPRE and TTYPE. Additionally, r6 showed high covariance with the latent

variable KSAs, with three disturbances (d1, d2, and d3), with r1, r5, and r8. Before removing the

nonsignificant path, the researcher attempted to revalidate the subconstruct of SOPRE to arrive at

a structural solution that might yield better results in the structural model. For this reason, an exploratory factor anlaysis (EFA) followed by a confirmatory factor analysis (CFA) was performed on the construct of SOPRE.

Exploratory and Confirmatory Factor Analysis (EFA & CFA) on Social Presence

The EFA on social presence was performed using principal axis factoring method and promax rotation. The pattern matrix was used for the identified factors. Factors with eigenvalues greater than 1.0 were extracted. Small coefficients with absolute value below .50 were supressed. The analysis extracted two factors: Factor 1 with SP 1-SP6, with item loadings ranging from .573 to .819, and Factor 2, with items ranging from SP9 to SP14, with item loadings ranging from .522 to .787. Actually, Factor 2 combines the items on cohesive and affective responses. Next a CFA on the social presence model was performed.

Model identification (N = 664). A CFA performed on the social presence two-factor 12-indicator model yielded the following results: $\chi^2(53) = 254.138$; CMIN/DF = 4.550; TLI = .924; CFI = .939; PGFI = .640; RMSEA = .073; SRMR = .058; and AIC = 291.138.
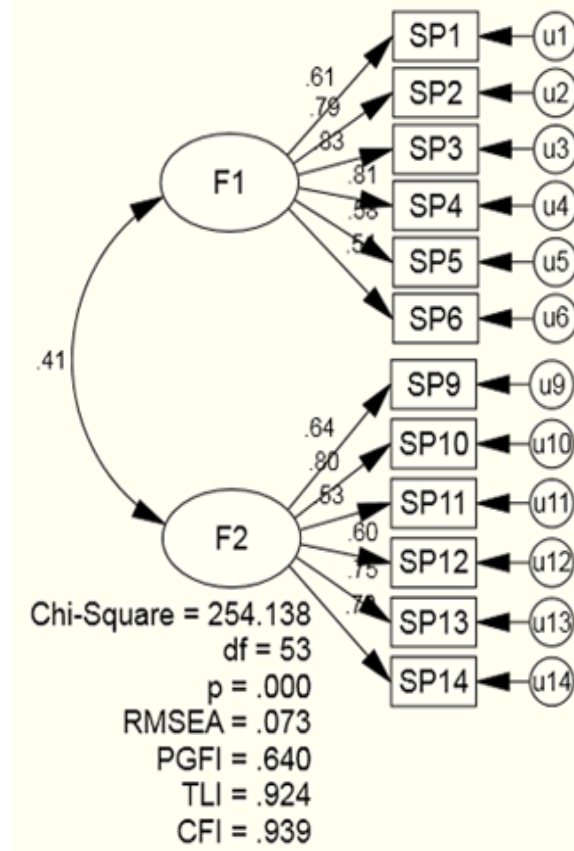
Figure 4.19. Standardized Solution for SOPRE initial model (F1-interactive responses, F2-cohesive and affective responses)

Though RMSEA, SRMR, CMIN/DF could be accepted, TLI and CFI were lower than the cutoff level of .95. Modification indices revealed a high covariance between SP13 and SP14. Analyzing the covariance within the model suggested that eliminating SP14 would decrease χ^2 by 84.664, whereas eliminating SP13 would decrease χ^2 by 49.402. SP14 was eliminated from the model. Repeating the analysis on the SOPRE two factor 11-indicator model yielded the following results: $\chi^2(43) = 147.973$; CMIN/DF = 3.441; TLI = .950; CFI = .961; PGFI = .625; RMSEA = .061; SRMR = .055; and AIC = 193.975. Another indicator eliminating which model fit could have improved was SP9. By eliminating SP9 the χ^2 decreased by 62.378. SP9 was

eliminated from the model. Repeating the analysis on the SOPRE two-factor 10-indicator model yielded the following results: $\chi^2(34) = 89.557$; CMIN/DF = 2.634; TLI = .969; CFI = .976; PGFI = .601; RMSEA = .050; SRMR = .043; and AIC = 131.557. This model was a good fit to the data and was accepted. The scale reliability analysis yielded a Chronbach's alpha of .83.
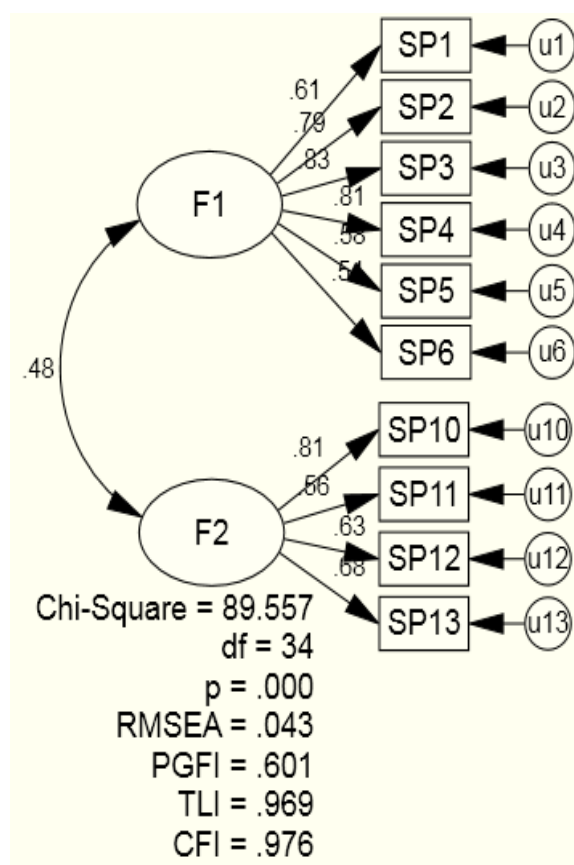

Figure 4.20. Standardized solution for SOPRE alternative model 1 (F1-interactive responses, F2-cohesive and affective responses)

Table 4.23 presents the standardized residual covariances matrix for social presence identified model. The values in the table are below 2.58. This confirms the absence of localized areas, a sign of good model fit.

Table 4.23

Standardized Residuals Covariance Matrix for SOPRE Identified Model

	SP13	SP12	SP11	SP10	SP6	SP5	SP4	SP3	SP2	SP1
SP13	0									
SP12	-0.203	0								
SP11	-0.133	0.045	0							
SP10	0.596	-0.375	-0.277	0						
SP6	-1.055	0.520	1.546	0.462	0					
SP5	-2.494	0.596	1.104	-0.884	3.321	0				
SP4	-1.628	2.234	1.204	-0.340	-0.597	-0.068	0			
SP3	-2.035	1.403	1.159	-0.444	-0.177	0.077	0.038	0		
SP2	-1.083	2.333	0.299	0.352	-0.808	-1.048	0.267	0.127	0	
SP1	-1.690	1.250	2.553	-0.699	0.738	0.207	-0.263	-0.188	0.220	0

Model reestimation (sample B, N = 692). The SOPRE model was re-estimated with Sample B. This analysis also yielded good results: $\chi^2(34) = 102.592$; CMIN/DF = 3.017; TLI = .961; CFI = .971; PGFI = .600; RMSEA = .054; SRMR = .041; and AIC = 144.592. The results of the analysis showed a good fit to the data.

Table 4.24 presents the results of the analysis on the SOPRE model.

Table 4.24

Results of Analysis on SOPRE Models

	χ2	p	Df	Δχ2	TLI	CFI	PGFI	RMSEA	SRMR	AIC
Initial (2-factor, 12-indicator)	**254.14**	**0.000**	**53**		**0.92**	**0.94**	**0.64**	**0.07**	**0.06**	**291.14**
Alternative 1 (2-factor, 11-indicator)	147.97	0.000	43	106.17	0.95	0.96	0.63	0.06	0.06	193.98
Alternative 2-identified (2-factor, 10-	**89.56**	**0.000**	**34**	**58.41**	**0.97**	**0.98**	**0.6**	**0.05**	**0.04**	**131.56**

indicator)

Reestimation (Sample B)	102.59	0.000	34	-13.03	0.96	0.97	0.6	0.05	0.04 144.59

Back to the Structural Model

The knowledge sharing structural model below (alternative model 1) presents a fine-tuned model with SOPRE latent variable presented through two summed score factors.
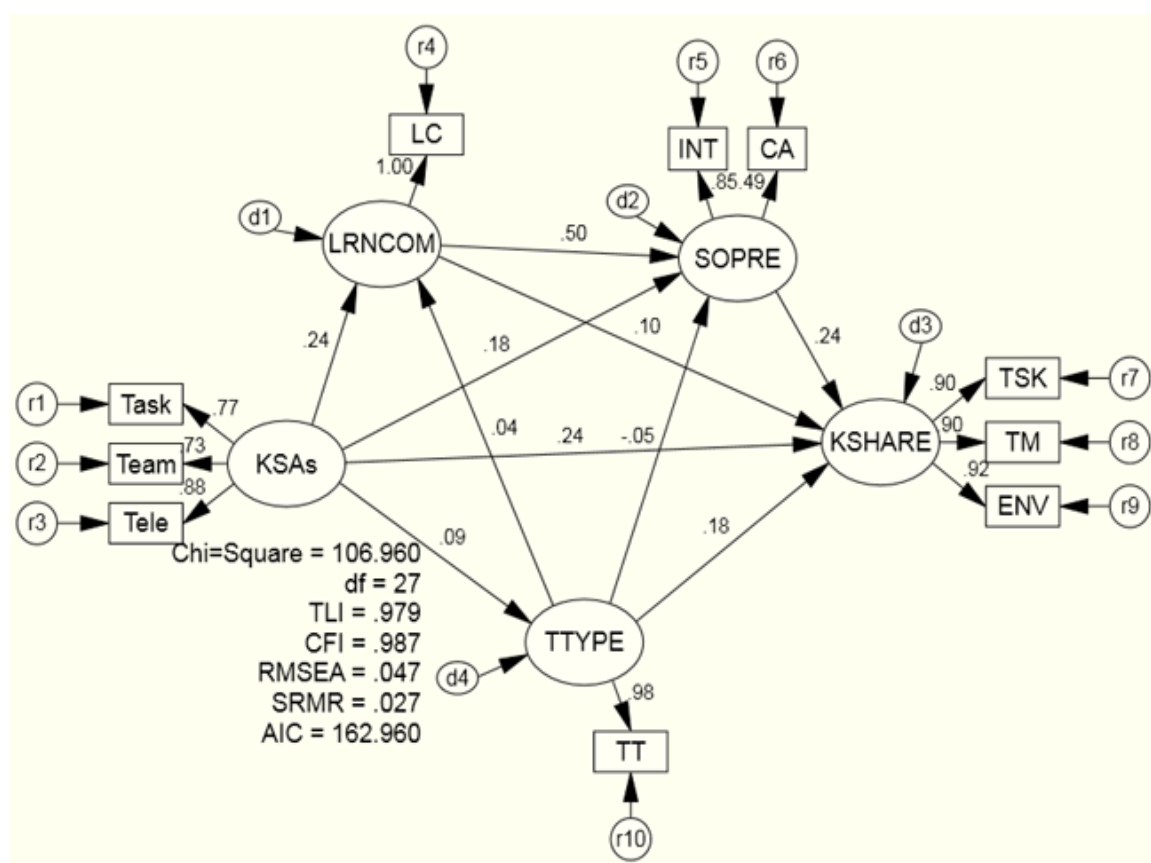
Figure 4.21. Standardized estimates for knowledge sharing alternative model 1. The model is not a good fit for the data.

The alternative model 1 solved the problem of correlated errors, but it still showed nonsignificant paths between LRNCOM and TTYPE (p = .196) and SOPRE and TTYPE (p = .051). These paths were eliminated from the model. .
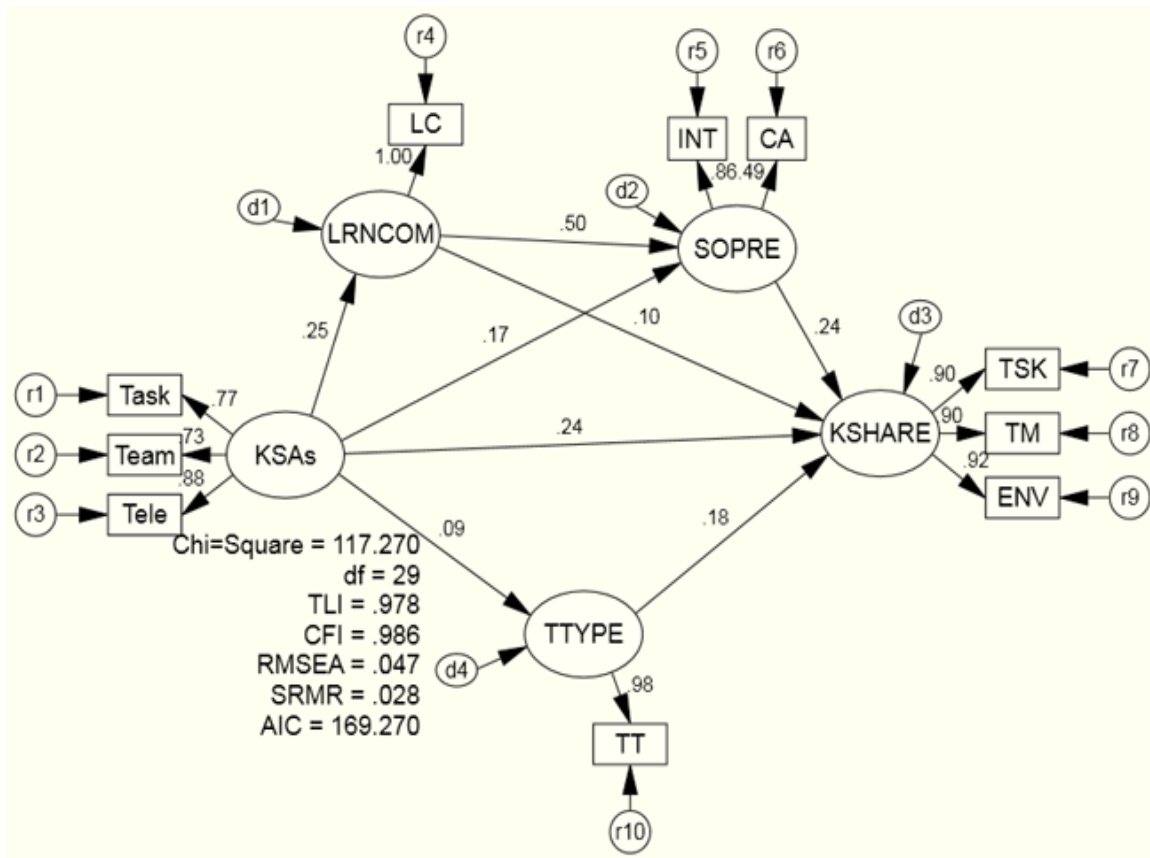
Figure 4.22. Standardized estimates for knowledge sharing alternative model 2. The model is a good fit for the data.

The results of the analysis suggested 55 distinct sample moments, 26 distinct parameters to be estimated, and 29 degrees of freedom. The indices of comparative fit are above the cutoff level (TLI = .980, CFI = .980), RMSEA is below .05 (.049) and SRMR is .027. With large sample sizes *p* value is always significant. For this reason, the value of PCLOSE is a better

indicator of model fit. A PCLOSE equal to.749 was obtained. This model was found to be a good

fit to the data and was accepted.

Table 4.25 below presents the standardized residual covariances matrix. The values in the

table are below 2.58 and confirm that the model is a good fit to the data.

Table 4.25

Standardized Residuals Covariance Matrix for Knowledge Sharing Identified Model

	CA	INT	TT	LC	Task	Team	Tele	ENV	TM	TSK
CA	.000									
INT	.000	.000								
TT	-1.938	-.856	.000							
LC	.569	-.105	1.253	.000						
Task	-.176	1.687	1.958	.800	.000					
Team	1.858	1.245	-2.410	1.885	-.811	.000				
Tele	-1.372	-1.128	.019	-1.152	.109	.241	.000			
ENV	-1.160	-.100	.283	.156	1.376	.845	-1.214	-.008		
TM	-.784	.554	-.483	1.508	1.906	1.093	-1.173	-.048	-.007	
TSK	-2.121	-.225	.042	-1.110	1.556	.258	-.723	.034	-.010	-.007

Table 4.26 presents the results of the analyses on knowledge sharing initial and alternative

models.

Table 4.26

Results of Analysis of Knowledge Sharing Models

MODEL	χ^2	*df*	$\Delta\chi^2$	Δdf	p	AIC	PCFI	RMSEA (90% CI)
Initial (saturated)	369.75	36			0.000	429.75	0.62	.0.83 (0.08-0.09)
Alternative 1 (SOPRE 2-factor)	106.96	27	262.79	9	0.000	162.96	0.59	0.05 (0.04 -0.06)
Identified (nonsignificant paths removed)	112.42	29	-5.46	-2	0.000	164.42	0.64	0.05 (0.34 -0.06)

Now it is time to interpret the model looking at its direct, indirect and total effects.

Table 4.27 below presents the different effects in the model.

Table 4.27

Standardized Direct, Indirect, and Total Effects of Predictor Variables on Knowledge Sharing

VARIABLE	DIRECT EFFECT	INDIRECT EFFECT	TOTAL EFFECT
VLT Competencies (KSAs)	0.239	0.111	0.350
Task Type (TTYPE)	0.177	0.000	0.177
Learning Community (LRNCOM)	0.101	0.120	0.220
Social Presence (SOPRE)	0.239	0.000	0.239

Direct effects. The direct effects of the four variables on knowledge sharing are as follows: social presence (SOPRE) (.24, large), competencies (KSAs) (.24, medium), TTYPE (task type) (.18, medium) and learning community (LRNCOM) (.10, small almost medium). This means that in VLT, where the level of social presence is high, team members are more likely to engage in knowledge sharing behavior. In the same manner, students with higher levels of competencies for working with virtual learning teams are more likely to share their knowledge with others. Additionally, the results suggest that if the task design is high on interdependence, VLT members are more likely to share their knowledge with other VLT members. Further, learning community can also predict VLT individual members' knowledge sharing behavior, although its effect on knowledge sharing is small. In other words, if students' expectations from their learning community are met, they are more likely to engage in knowledge sharing behavior.

Indirect effects. The following indirect effects have been identified in the model: (a) KSAs →LRNCOM → KSHARE, (b) KSAs→SOPRE→KSHARE, (c) KSAs→ TTYPE -→ KSHARE, and (d) LRNCOM →SOPRE→KSHARE. This model suggests that LRNCOM,

SOPRE, and TTYPE are partial moderators of the relationship between KSAs and KSHARE. SOPRE is also a partial moderator of the relationship between LRNCOM and KSHARE. For example, the standardized indirect effect of KSAs on KSHARE through LRNCOM means that KSAs have a certain direct effect on LRNCOM (.25), but only part of this effect (.10) is transmitted to KSHARE. The indirect effect of KSAs on KSHARE via LRNCOM is estimated as the product of the standardized coefficients for the paths KSAs --> LRNCOM and LRNCOM-->KSHARE, or .25*.10 = .03. The result .03 tells that the level of knowledge sharing is expected to increase by .03 standard deviations for every increase in KSAs of one full standard deviation via its prior effect on LRNCOM. In a similar manner, KSHARE is expected to increase by .04 standard deviation for every increase in KSAs of one full standard deviation via its prior effect on SOPRE, and KSHARE is expected to increase by .02 standard deviation for every increase in KSAs of one full standard deviation via its prior effect on TTYPE. Additionally, KSHARE is expected to increase by .12 standard deviation for every increase in LRNCOM of one full standard deviation via its prior effect on SOPRE.

  Total effects. Total effects are the sum of all direct and indirect effects of one variable on another. Total effects could be discussed in relation to individual variables and in relation to the entire model. Looking at total effects of the variables in the model, we can identify those variables that have larger effects on the outcomes variables in the entire model. The total effect of KSAs through each of the three variables individually is as follows: (a) KSAs → LRNCOM → KSHARE =.27, (b) KSAs→ SOPRE→ KSHARE = .28, and (c) KSAs→ TTYPE→ KSHARE = .26. These total effects are calculated by adding the direct effect of KSAs on KSHARE to the indirect effects of KSAS on KSHARE. Additionally, AMOS presents the size of total effects of the variables through different paths in the following way. The total effect of TTYPE and

SOPRE on KSHARE is equal to their direct effects (.18 and .24, respectively) because the

indirect effects are missing. The total effect of KSAs on KSHARE in the model is .35, and the

total effect of LRNCOM on KSHARE is .22.

In summary, competencies and social presence have equal medium direct effect on

knowledge sharing, which means that both can count for equal amount of variance in knowledge

sharing. Task type has only medium direct effect on knowledge sharing.   Additionally, when

entered into the model together, the total effect of competencies on knowledge sharing is large,

followed by the medium total effect of the other three variables, (i.e. learning community, social

presence and task type).   This means that VLT individual members' level of VLT competencies

has stronger explanatory power in the knowledge sharing model than the other three variables.

Statistical power. The large sample size in the study controls for the statistical power.

Multigroup Analysis of Knowledge Sharing Model

A multigroup analysis was also conducted on the VLT knowledge sharing model to

identify whether the model analyzed with gender (males versus females), ethnicity (Blacks

versus Whites), level of study (undergraduates versus graduates), age (24–35 versus 45–54), and

academic major (business versus education versus health) would yield the same model structure.

The results of the analysis suggest that none of the variables listed above moderate the model

structure.

Table 4.28 below presents the results of multigroup analyses on the knowledge sharing

structural model.

Table 4.28

Results of Multigroup Analysis of Knowledge Sharing Model

MODEL	N	χ2	df	p	AIC	TIL	CFI	PCFI	SRMR	RMSEA (90% CI)	PCLOSE
Identified	1,35 5	**117.27**	**29**	**0.000**	**169.27**	**0.978**	**0.986**	**0.635**	**0.028**	**0.047 (0.039- 0.057)**	**0.667**
Males	368	71.448	29	0.000	123.448	0.965	0.977	0.630	0.045	0.063 (0.045- 0.082)	0.113
Females	974	75.017	29	0.000	127.017	0.984	0.989	0.638	0.027	0.040 (0.029- 0.052)	0.916
Whites	936	97.674	29	0.000	149.674	0.975	0.984	0.634	0.031	0.050 (0.040- 0.062)	0.460
Blacks	236	29.753	29	0.426	81.753	0.999	0.999	0.644	0.030	0.011(0.000- 0.051)	0.942
Age (24-30)	387	47.013	29	0.019	99.013	0.985	0.990	0.638	0.032	0.040 (0.017- 0.060)	0.770
Age (45 -54)	343	43.948	29	0.037	95.948	0.984	0.989	0.638	0.032	0.039 (0.010 -0.061)	0.777
Undergrads	613	59.402	29	0.000	111.402	0.984	0.990	0.638	0.030	0.041 (0.026- 0.059)	0.817
Grads	644	66.572	29	0.000	118.572	0.980	0.987	0.636	0.032	0.045(0.031- 0.059)	0.705
Business	306	34.166	29	0.233	86.166	0.994	0.996	0.642	0.030	0.023 (0.000-0.052)	0.933
Education	365	56.614	29	0.000	108.614	0.973	0.982	0.633	0.038	0.051 (0.031-0.071)	0.435
Health	204	54.832	29	0.003	106.832	0.957	0.972	0.627	0.043	0.066 (0.039-0.093)	0.151

Summary

While knowledge sharing has been much discussed outside of education, in higher education and in distance education it has been under-researched. The present study asserts that it is possible to design a model of knowledge sharing for virtual learning teams leading to better understanding of the causal mechanisms supporting knowledge sharing behavior. Accordingly, a theoretical model of knowledge sharing in VLTs was designed that presents relationships between knowledge sharing and a number of predictor variables. A structural equation modeling (SEM) analytical framework, a rigorous analytical technique, was used to validate the model. Further, the validated model was cross-validated with a multigroup sample representing the variables of gender, ethnicity, age, academic level, and study area. This chapter described the data handling procedures, the sample, and its knowledge sharing behavior in VLTs. It reported the results of regression analysis, based on which predictors that showed a statistically significant relationship with knowledge sharing were identified and entered into the measurement model. Before entering the subconstructs into the measurement model, they were validated through

confirmatory factor analysis. The approach towards model fitting in CFA has been as follows. Because most of the measures in this study were validated in prior research and had a set number of indicators loading on certain factors, the researcher decided to enter them into confirmatory factor analysis as such. The number of indicators on different factors ranged from 2 to 10. For instance, the competencies construct was presented through three factors with a range of 2 to 6 summed score indicators loading on them. The construct of learning community, on the other hand, was used as a single-factor 10- indicator (item) model in CFA and a single summed score indicator model in SEM. However, the study made an attempt, wherever possible, to keep at least three indicators loading on each factor, because this number has been discussed as the minimum number of indicators appropriate to represent a latent variable (Costello & Osborne, 2005). In extreme cases, the study had to accept a one- or two-indicator factor, with the understanding that it presented a limitation for the study. Some problems arose related to indicator-factor incorrect relationships. There were cases when the indicator did not seem to be representative of the factor or showed cross-loadings. Then an attempt was made to redefine the model by loading the indicator on other factors. If the model fit did not improve, the indicator was eliminated from the model. The researcher expected to get and got some correlation errors related to reverse-worded items on different measures. When it was impossible to correct the errors, the items were eliminated from the study.

When analyzing the initial structural model of knowledge sharing, social presence subconstruct (three-indicator with summed scores) showed poor fit inside the model. The study went back to conducting an exploratory factor analysis on social presence and a two-factor model was identified and the initial subconstruct of social presence was replace by it. Because of the change in this subconstruct, the knowledge sharing structural model itself was re-estimated.

The multigroup analysis on the identified model of VLT knowledge sharing suggested that the model had the same structure when analyzed with different groups of participants, which affirms the generalizablity of the model among the population researched.

CHAPTER 5: DISCUSSION

The current study used the model of triadic reciprocal causation (Bandura, 1986) as its
theoretical framework to look at the relationship between person (P), environment (E) and
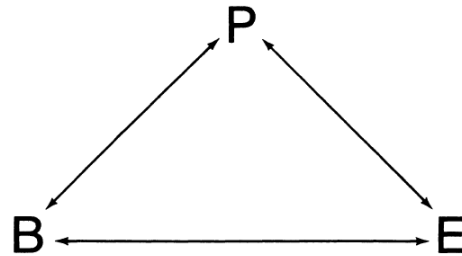behavior (B).

Figure 5.1. Model of triadic reciprocal causation (Bandura, 1986, p. 24)

This study made contributions to research, theory, and practice.

Discussion of Findings

Behavior (B)

The results of the study support H1 that the majority of participants will report high
levels of knowledge sharing in VLTs. The majority reported that they shared everything or
almost everything with others. This finding supports the empirical research on knowledge
sharing that was discussed in Chapter 2. While this finding is promising, it must be noted that
approximately one-fifth of the respondents reported lower levels of knowledge sharing, and a
small number within this number reported withholding knowledge from others. Indeed, previous
research has revealed reluctance in knowledge sharing in different contexts (Husted &
Michailova, 2002). According to Clark (cited by Santo, 2002), one of the "hardest things to do in
any online community is to get people to give information. One reason is that people just don't
naturally think their way of doing things has value" (p. 1).

Person (P)

The current study found partial support for H2, that the competency framework designed for virtual teams in the workplace is applicable to virtual learning teams in distance education. The study confirmed the competency framework as a three-factor (task work, teamwork, telecooperation) and eight-indicator (loyalty, integrity, conscientiousness, communication, cooperation, creativity, persistence, and self-efficacy) model. In other words, the original three-factor eleven-indicator model had to be somewhat adapted to be used with distance education students. The confirmed competency framework can work equally well with virtual teams in the workplace and with virtual learning teams in distance education. The three indicators that have not been confirmed are interpersonal trust, intercultural communication, and learning motivation.

Assumptions could be made about why interpersonal trust, intercultural communication, and learning motivation did not fit well within the competencies model. By their nature, VLTs are temporary teams that come together for a limited time (five to six weeks). VLT members may not have worked with one another previously and may not work together in the future. Jarvenpaa, Knoll, and Leidner (1998) point out that the members of short-term teams may not have time to develop trust. They will benefit if they act as if trust is present from the start. Jarvenpaa and Leidner (1999) note that for the development of a positive team climate the disposition to trust other team members is very important. Yet, despite the importance of trust for team processes, the study found somewhat low levels of trust in VLTs. This finding is in line with previous research. For instance, a study conducted by Johnson, Suriya, Yoon, Berrett, and La Fleur (2002) on virtual learning team development and group processes reports that, though some students seemed to trust others on virtual learning teams, others, despite their willingness to trust, did not because they did not know their team members, and they "never became a team"

because of "spotty participation throughout" (p. 389) and unfinished tasks. Johnson et al. (2002) note that absence of face-to-face meetings can affect the development of trust in teams.

The low levels of intercultural communication found by the study could be related to virtual learning team members' low levels of experience with international interactions. In an overview of higher education across borders, Altbach (2004) discusses the participation of students from different parts of the world in American education. International students have various social and political reasons to enroll in U.S. educational institutions. They seek not only education in the U.S., but also postgraduation experiences and further employment. Altbach (2004) further notes that in 2004 the U.S. had around 586,000 international students; it has been considered the largest host country that is home to more than a quarter of the world's foreign students. However, the number of foreign students participating in distance education seems to be much smaller than the number of those taking courses on physical campuses. The reason why intercultural communication failed to be confirmed within the framework of virtual learning team competencies most likely can be explained by the low numbers of foreign students participating in distance education, rather than by the unimportance of intercultural communication for the telecooperation of distance education students.

The third subconstruct that was not confirmed is learning motivation. Though distance education students' learning motivation is evident (they participate in education), a much closer look at the scale gives an impression that this construct seems to be close to persistence or perseverance. This subconstruct might need to undergo further exploration in distance education context so that the possible reasons why it has not been confirmed could be identified.

The results of the study also found support for H3, that competencies have a statistically significant, positive, and direct effect on knowledge sharing. This finding is in accordance with

the finding that competencies can help predict team effectiveness in physical and virtual teams (Hertel et al., 2006; Stevens & Campion, 1994). In both contexts, competencies have been related to effective outcomes on the team. Thus, we can say that the level of competencies in virtual learning teams can predict individual members' knowledge sharing behavior. This means that if students enter VLTs with a high level of competencies, they are most likely to engage in a higher level of knowledge sharing. However, we should not assume that if the students enter VLTs with a low level of competencies they should be accepted on that basis and that no change can be anticipated, because previous research notes that competencies are "learnable behaviors" (Steven & Campion, 1999, p. 208).

Environment (E)

The study found support for H8, that social presence has a statistically significant positive effect on knowledge sharing. The study identified a marginally moderate (almost large) direct effect of social presence on knowledge sharing. This finding is in line with discussions in previous research. For example, Leh (2001) points out that "when social presence is lacking, people recognize the environment as impersonal and share less" (p. 110). The results of the study conducted by Yoon (2003) suggest that social behaviors account for 26.3% of the total performed behaviors by virtual learning teams. This means that if we design instructional interventions so that social presence increases in virtual learning teams, students will be more likely to engage in higher levels of knowledge sharing behavior. The role of social presence in the community of inquiry (CoI) has been critiqued in recent years (as discussed earlier in the paper). The extent to which knowledge is coconstructed in most higher education settings has been questioned; and deficiencies have been found in two-way communication in online learning environments (Annand, 2011). Nevertheless, the results of this study confirm that social presence

has an effect on knowledge sharing. Actually, the direct effect of social presence on knowledge sharing is equal to the direct effect of competencies. This finding suggests that, although competencies are strong predictors of individual VLT members' knowledge sharing behavior, the level of social presence in VLTs can compensate for the level of competencies if it is low.

This study also found support for H9, that social presence mediates the predictive relationship between competencies and knowledge sharing and between learning community and knowledge sharing. This finding suggests that not only an environmental aspect (social presence) can mediate the relationship between person (competencies) and behavior (knowledge sharing); but as an environmental factor, it can also mediate the relationship between another environmental factor (learning community) and behavior (knowledge sharing). In other words, environmental factors also have relationships with each other towards behavior.

The results of the study found support for H10, that the learning community has a small but statistically significant meaningful effect on knowledge sharing. This finding confirms the importance of learning communities for supporting learning, as discussed in the literature (Barab, MaKinster, & Scheckler, 2004). Snyder (2009) refers to learning communities as "groups of people that share the common interests of learning and sharing knowledge" (p. 49); and Bielaczyc and Collins (1999) note the importance of the learning community in advancing collective and individual knowledge. Wegerif (1998) suggests that "forming a sense of community, where people feel they will be treated sympathetically by their fellows, seems to be a necessary first step for collaborative learning. Without a feeling of community people are on their own, likely to be anxious, defensive and unwilling to take the risks involved in learning" (p. 48). The findings of the present study suggest that if the individual VLT members' expectations of their learning team (e.g., encouragement for asking questions and timely feedback) are not

met, they may be reluctant to engage in knowledge sharing within their VLT. Additionally, the results of the study support H11, that learning community will mediate the relationship between competencies and knowledge sharing.

The results of the study support H14, that there is a statistically significant positive effect of task type on knowledge sharing. It is a moderate, direct effect. This finding is in keeping with earlier discussions of task type suggesting that different task types might require different amounts or levels of collaboration. Keeping in mind the task categories suggested by McGrath (1984), one can assume that, for VLT members to be willing to engage in knowledge sharing, VLT tasks must create opportunities for learners to engage in negotiation and execution. If the task design requires them to perform generating and choosing behaviors, the level of knowledge sharing in VLT might be rather low because these behaviors require little or no coordination among team members. From the perspective of social-cognitive theory (Bandura, 1997), task type can be considered an imposed environment (imposed by the instructor). VLT members will respond to the environmental stimuli, and if the stimuli for certain types of behavior are absent, then the corresponding type of behavior most likely will not be performed. This means that if tasks are designed so that they target knowledge sharing, students most likely will perform the desired behavior. VLT tasks should require a considerable amount of discussion and negotiation for meaning and strategy. Additionally, the results of the study support H15, that task type will mediate the relationship between competencies and knowledge sharing.

Four variables—learning goal orientation, performance goal orientation, satisfaction, and instructor strategies—did not show a statistically significant, positive, predictive relationship with knowledge sharing when entered into a simultaneous multiple regression analysis together with the four other predictors (competencies, learning community, social presence, and task

type). The second attempt to regress knowledge sharing on learning goal orientation, performance goal orientation, satisfaction, and instructor strategies in the absence of competencies, learning community, social presence, and task type suggested statistically significant positive relationship between knowledge sharing and learning goal orientation and satisfaction. The third attempt to regress knowledge sharing on instructor strategies and performance goal orientation individually suggested that instructor strategies had statistically significant positive relationship with knowledge sharing, whereas performance goal orientation did not. This means that learning goal orientation and satisfaction could be entered into another knowledge sharing model, and more factors should be identified that could be added to it. Also, other factors should be identified that could be entered into a knowledge sharing model together with instructor strategies.

Thus, the study found support for H4, that there is a statistically significant positive relationship between learning goal orientation and knowledge sharing. These results are in line with the findings of previous research on goal orientation. As discussed earlier in the paper, learning goal orientation is thought to predict interest and intrinsic motivation (Cury, Elliot, Da Fonseca, & Moller, 2006) and to lead to positive aspects of behavior (e.g., effort and persistence) (Elliot, McGregor, & Gable, 1999). Effort and persistence are very important for engaging into deep learning, which could be done if learners are ready to cooperate. And since learning goal orientation is cooperative in nature, learners with learning goal orientation are likely to be willing to engage in knowledge sharing, which is also a cooperative behavior.

The study found support for H12, that there is a statistically significant positive relationship between satisfaction and knowledge sharing. Previous research on satisfaction suggests that satisfaction with team experiences positively relates to teamwork quality and

product quality (Campion, Papper, & Medsker, 1996; Hoegl & Gemuenden, 2001). VLTs, similar to other teams, have psychological needs (Gallivan, 2001). Along with the different outcomes discussed in the literature, teamwork also has people-related outcomes (Hoegl & Gemuenden, 2001), which Kotlarsky and Oshiri (2005) refer to as "positive social experience" (p. 40). They emphasize the importance of personal satisfaction for motivating individuals and teams to continue engaging in collaboration, despite geographical, time, and cultural differences. This means that for individual VLT members to engage in knowledge sharing behavior, it will be important for them to feel satisfied with their VLT.

The study found support for H16, that there is a statistically significant direct relationship between instructor strategies and knowledge sharing. Previous research on instructor strategies identified some of those strategies that can help student teams be effective (e.g., assisting group formation, building a sense of connectedness, being involved in in-group processes, and evaluating group processes) (Koh, Barbour, & Hill, 2010). Youngblood, Trede, and Di Corpo (2001) grouped the tasks of online instructors into four categories: (a) setting the scenes; (b) monitoring participation; (c) facilitating critical thinking, and (d) promoting student collaboration. Promoting student collaboration will be especially important if we want to enhance knowledge sharing in virtual learning teams. In virtual classrooms, instructors have power and authority to create and manage the learning environment and to set the tone of interaction. Garrison, Anderson, and Archer (2000) argue that instructor/instructional presence contributes to learners' cognitive presence more than anything else. The strategies that this study used have been identified by Koh et al. (2010). However, one can make an assumption that the construct of instructor strategies may have a much wider scope than the one used in this study.

Therefore, future research can focus on identifying and validating a construct of instructor strategies in distance education that may relate to knowledge sharing behavior in VLTs.

Since learning goal orientation, satisfaction, and instructor strategies were not entered into the knowledge sharing model, this study could not test their mediating effects, which means that H5, H13, and H17 have not been tested. Though goal orientation, satisfaction, and instructor strategies were not entered into the knowledge sharing model tested in this study, they can be entered into other knowledge sharing models for VLTs that include different predictor variables.

This study did not find support for H6, that is, there is no statistically significant predictive relationship between performance goal orientation and knowledge sharing. Performance goal orientation did not show a statistically significant positive relationship with knowledge sharing under any of the following conditions: (a) when entered into a multiple regression analysis with all the other variables, (b) when entered into a multiple regression analysis with the three variables not entered into the knowledge sharing model, and (c) when entered into a bivariate linear regression analysis. Performance goal orientation, as described by many (e.g., Nicholls, 1984; Dweck, 1986), most probably leads to more self-centered behavior, with individuals focusing on themselves rather than on the needs and feelings of others. Performance goal orientation is thought to be competitive in nature, which may be the reason why it cannot be a predictor of a cooperative behavior such as knowledge sharing, although the initial assumption of the researcher was that individuals with performance goal orientation might engage in knowledge sharing behavior to exhibit their knowledge. Since performance goal orientation has not been entered into the knowledge sharing model, its moderating effect has not been analyzed. In other words H7 has not been tested.

The results of the study found partial support for H18, which stated that the VLT knowledge sharing model can be comprised of nine variables. Only four predictors—competencies, learning community, social presence, and task type—were found to have statistically significant relationships with knowledge sharing, and they were entered into the measurement model.

The study found support for H19, that the VLT knowledge sharing model, tested with gender, ethnicity, age, academic level, and study area, yields the same model structure. None of the listed variables moderated the model structure. This finding seems to affirm the generalizability of the model for the student populations within the distance-education university from which the sample was selected.

Table 5.29 below lists the hypotheses and whether or not they were supported or tested through different analyses in the study.

Table 5.29

Hypotheses and Results Summary

Hypothesis	Statement	Results
1	Majority will report high levels of knowledge sharing.	Supported
2	VTCI can be used to measure competencies of distance education students for working on virtual learning teams.	Partially supported
3	Competencies have statistically significant positive direct effect with KSHARE.	Supported
4	LG has statistically significant positive direct effect with KSHARE.	Supported
5	LG mediates the direct effect between competencies and KSHARE.	Not tested
6	PG has statistically significant positive direct effect with KSHARE.	Not tested
7	PG mediates the relationship between competencies and KSHARE.	Not tested
8	SOPRE has statistically significant positive direct effect on KSHARE.	Supported
9	SOPRE will mediate the relationship between competencies and KSHARE.	Supported
10	LRNCOM has statistically significant positive direct effect on KSHARE.	Supported

11	LRNCOM will mediate the relationship between competencies and KSHARE.	Supported
12	SAT has statistically significant positive direct effect on KSHARE.	Supported
13	SAT will mediate the relationship between competencies and KSHARE.	Not tested
14	TTYPE will have statistically significant positive direct effect on KSHARE.	Supported
15	TTYPE will mediate the relationship between competencies and KSHARE.	Supported
16	INST has statistically significant positive direct effect on KSHARE.	Supported
17	INST will mediate the relationship between competencies and KSHARE.	Not tested
18	Knowledge sharing model consists of eight variables.	Not supported
19	Knowledge sharing model will yield identical results when tested with gender, ethnicity, age, academic levesl, study area.	Supported

Contribution to Research

This study contributes to the research on knowledge sharing. Previous research focused on knowledge sharing in relation to different antecedents. A study by Ford (2004) points out that knowledge sharing in previous research was studied in relation to organizational factors, individual factors, perceived experience, attitudes to knowledge sharing, and technological factors. For instance, Ford (2004), Chen et al. (2009), and some other colleagues studied knowledge sharing in relation to attitudes and subjective norms. Knowledge sharing was also studied in relation to receiver needs (Lichtenstein & Hunter, 2004). This study contributes to this line of research by expanding the list of antecedents of knowledge sharing. Additionally, it contributes to the line of research on small group learning because it sheds light on some of the aspects of social dynamics in virtual learning teams in distance education. While doing so, it explores the psychosocial factors affecting the functioning of virtual learning teams, an area that seems to be under researched both in organizational research (Martins et al., 2004) and in computer-supported collaborative learning (CSCL) (Kreijns, Kirschner, & Jochems, 2003). As Kreijns et al. (2003) note, the main focus in CSCL has been on cognitive aspects of learning

rather than on socioemotional aspects, and this has resulted in the designing of functional CSCL environments that "forget that we are dealing with human beings" (p. 349). Kreijns, et al. (2003) cited Sproull and Faraj (1997, p. 38), who bring to our attention that "people on the net are not only solitary information processors, but also social beings. They are not only looking for information; they are also looking for affiliation, support and affirmation" (p. 38). In short, this research sheds more light on what contributes to knowledge sharing from the perspective of the person and the socioemotional environment.

Additionally, this study builds on the work of Lin, Hung, and Chen (2009) and of Ford (2004). Lin et al. (2009) used social cognitive theory (Bandura, 1982, 1986, 1997) to study the relationships between contextual factors, knowledge sharing, and community loyalty by adding to the number of predictors under the same theoretical framework. Lin et al. (2009) studied members of three professional virtual communities. The current study expands the findings into the distance education setting. Lin et al.'s (2009) study used knowledge sharing self-efficacy, perceived relative advantage, and perceived compatibility as mediating variables, and among other things, suggested that trust significantly influences knowledge sharing self-efficacy. In the present study, trust was not confirmed in the competency framework, and it was therefore excluded from that framework.

Ford (2004) used categories of knowledge sharing/hoarding to explore the behavior. The present study, adopted the concept of knowledge sharing/hoarding and used it with distance education students as knowledge sharing/withholding. The triadic model of reciprocal causation in the distance education context was tested and found to be a good support for the VLT knowledge sharing model. The present study found that different components within the category of "environment" of the reciprocal causation model can also affect distance education

students' knowledge sharing behavior in VLTs. Because previous research on VLT knowledge sharing in distance education is sparse, this model can serve as a starting point for gathering more variables characteristic of person and environment that can relate to VLT members' knowledge sharing behavior in distance education.

Contribution to Theory

Corley and Gioia (2011) provide a general definition of theory as "a statement of concepts and their interrelationships that shows how and/or why a phenomenon occurs" (p. 12). The present study used both a combination of deductive and inductive approaches and suggested a model in which subconstructs and their interrelationships were validated through empirical research. Whetten (1989) points out that a complete theory should contain four essential elements: (a) *What,* relating to variables, constructs and concepts that "logically should be considered as part of explanation of the social or individual phenomena of interest" (p. 490), (b) *How,* relating to the relationships between the identified factors, (c) *Why,* relating to the "underlying psychological, economic, or social dynamics that justify the selection of factors and the proposed causal relationships" (p. 491), and (d) *Who, where, when,* which "set boundaries of generalizability, and . . . constitute the range of the theory" (p. 492).

Regarding *what*: This study explored the relationships between a comprehensive set of concepts including learner characteristics (e.g., competencies), context characteristics (e.g., social presence), learning tasks (e.g., task type), instructional strategies (e.g., instructor strategies), and learner behaviors (e.g., knowledge sharing) that were assumed to play a role in the instructional process. These concepts are central to instructional design, which seeks to determine the optimal degree of instructional support (Smith & Regan, 2005). A considerable amount of research has attempted to derive univariate principles for instructional design (Smith

& Regan, 2005). This study succeeded in deriving multivariate principles of knowledge sharing, framing them in a model in which direct and indirect relationships between model components were identified and tested. This study assured comprehensiveness and parsimony of the research by including more factors than needed, then selecting through testing the ones that could have value in the knowledge sharing model. Therefore, this study is in line with the statement that Whetton (1989) made: "When authors begin to map out the conceptual landscape of a topic they should err in favor of including too many factors, recognizing that over time their ideas will be refined" (p. 490).

Regarding *how*: The proposed model is supported by causal relationships. Although the study gathered data through a survey (rather than through experimental research, which allows one to identify true cause and effect relationships), the relationships between the variables in the study are based on the following logic: If the VLT members' level of competencies for working on the VLT is high, if they are satisfied with their learning community, if social presence is high in the VLT, and if the offered VLT tasks are high on interdependence, then the VLT members will engage in higher levels of knowledge sharing in their VLT.

Regarding *why*: The study provides sound theoretical support for selection of the proposed factors and for the causal relationships. The suggested model extends existing knowledge on knowledge sharing in small groups; it is an original model of its type, and it can be used as a conceptual framework for designing instructional environments for VLT learning in distance education. Therefore, this research furthers theoretical conceptualization of learning in VLTs in distance education.

Regarding *who, where, when*: This study presents inductively generated theory. While this research was not designed to test the generalizability of the proposed model beyond the

population studied, within the population studied, it assured the generalizability among samples representing different characteristics, including gender, academic level, age, and ethnicity. Additionally, this study can serve as a starting point for testing the proposed VLT knowledge sharing model (theory) in different contexts and with different distance learner populations.

Contribution to Practice

This study will have utility for instructional designers and instructors. Instructional designers can use it to design instructional environments to enhance the development of learning communities and raise the level of social presence in VLTs. Tasks conducive to high interdependence can be designed for different areas of study. Instructors can encourage development of learning communities within VLTs and can support the creation of social presence in VLTs, so that knowledge sharing in VLTs occurs at higher levels. Different activities can be designed to help learners understand (a) what knowledge in a VLT is, (b) why they need to share different types of knowledge with other VLT members, and (c) the possible consequences of sharing or not sharing knowledge. These activities can also help instructors understand what types of knowledge learners easily share and or/withhold. At the end of each team assignment, knowledge sharing evaluation forms such as the following can be used: (a) a form for self-assessment of knowledge sharing behavior, and (b) a form for mutual assessment of the knowledge sharing behaviors of each VLT member. This activity will target a number of things at the same time. First, it will raise awareness in learners about the importance of knowledge sharing in VLTs. Second, it will encourage each student to reflect on his/her own knowledge sharing behavior by comparing it to the team's perception of his/her knowledge sharing behavior. Any gaps between the two can also be discussed with the entire team.

This study validated a competency framework as a subconstruct in the knowledge sharing model. Students can be oriented to the confirmed competencies. Therefore, activities can be designed to facilitate better understanding and appreciation of loyalty, integrity, cooperation, persistence, and so on in computer-supported collaborative learning before learners engage in tasks related to their actual online course content. The activity should highlight the link between competencies and knowledge sharing behavior, particularly the benefits that VLTs will gain if those competencies are used, and the losses that they may face if they are not used.

Learning community support is another factor that can encourage students' knowledge sharing behavior. Distance education students often take one course after another in a rush, and most of them are nontraditional students with responsible jobs that consume most of their energy during the day. Because the learners' needs are diverse, the levels of their expectation for learning support can also be diverse. Although there is anecdotal evidence that students come to VLTs expecting support from other team members, and they do appreciate it when it is provided, learners with high self-efficacy may have different expectations of their VLTs; being more self-sufficient, they may not realize the importance of this type of environment for their fellow learners. For this reason, another activity can be designed that will assess VLT members' expectation of support for learning within their VLTs. During the course, they could come back to unmet team milestones and discuss these with fellow team members, thereby developing mutual trust and cultivating a cooperative spirit.

Findings in this study suggest that level of task interdependence impacts knowledge sharing behavior in VLTs. According to McGrath (1984), tasks require different levels of collaboration. VLT task design should require interdependence of learners so that learners can only complete the tasks effectively if they plan and coordinate their efforts with other VLT

members. In order for this to happen, VLT members could receive different parts of the same task, which they have to understand and explain to other VLT members so that the different components of the tasks can be integrated into a whole.

Although in recent years "social presence," as defined by the community of inquiry framework, was critiqued on the grounds that the actual amount of knowledge coconstruction in higher education settings seems questionable (Annand, 2011), social presence in VLTs does seem to have effect on knowledge sharing. This means that social presence should be encouraged even more in virtual classrooms. Instructors can model social presence to foster the development of social presence in VLTs. For instance, when instructors do not make themselves socially present during online course delivery, learners may be reluctant to project themselves socially. There are a variety of ice-breaking activities for entirely web-enhanced instructional models that may encourage social presence in virtual classrooms. For instance, students could be encouraged to come up with the "tip of the day," or the "joke of the day," or something that "I cannot help sharing today." Or ask students to tell "three truths and a lie" about themselves and then have the entire class guess which are the truths and which is the lie.[4] Experience suggests that students appreciate instructors who engage them in discussions, provide timely feedback, and create a friendly atmosphere in virtual classrooms because similar activities can lower students' level of course-related anxiety.

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[4] Information on icebreakers was retrieved from the following websites:
http://twt.wikispaces.com/Ice-Breaker+Ideas
http://www.southalabama.edu/oll/jobaidsfall03/Icebreakers%20Online/icebreakerjobaid.htm
http://joitskehulsebosch.blogspot.com/2009/03/10-online-icebreakers.html
http://introductiononlinepedagogy.pbworks.com/w/page/20123544/Icebreakers

Strengths and Limitations

This study has a number of strengths. First, it identified supports for knowledge sharing in VLTs and suggested a framework that can be used to measure knowledge sharing in VLTs in distance education. Second, it validated an instrument that could be used to measure individual VLT members' competencies for working on VLTs. Third, the study used structural equation modeling techniques to conduct a careful examination of different measurement models and considered the measurement errors before entering the subconstructs into the measurement model to identify the relationships within the model. Fourth, because the meaning of one construct is not the same across groups with different characteristics (related to gender, academic level, ethnicity, age, and area of study), the study cross-validated the VLT knowledge sharing model with different groups of participants (e.g. gender). This fact contributed to the generalizability of the model within the population from which the sample was selected. Fifth, the study collected data from students who dispersed geographically because distance education brings together students from different locations. Sixth, the study gathered data from a large sample size, which made it possible to use different groupings of the sample for different analyses in the study.

The study also has a number of limitations. First, it was conducted in one online university and at one point in time. Drawing the sample from one university might limit the generalizability of the study or the conclusions that the researcher makes because other distance education universities might not share the outcome-based instructional model that this university uses. This university uses standardized approach to syllabus and towards the instructional process, whereas other distance education universities or programs might provide with more academic freedom. This university does not have residency requirements, while some other

distance education programs (e.g. in Syracuse University) have residency requirements that create an opportunity for learning team members to meet face to face for a short period of time before starting to work with each other. The fact that this university policy clearly defines the environment in which VLTs should function, provides an evaluation framework against which team members should evaluation one another can affect teaming can affect teaming. Second, it gathered data on individual VLT members' perceptions of the constructs of interest. Third, there were unequal numbers of participants in different categories, and although the researcher tried to use several criteria for validating the models, the difference in the sample sizes could have affected the results. Fourth, the length of the questionnaire (total of 132 items, including 118 main survey items and 14 general and demographic information items) may have affected respondents' ability to concentrate while completing the survey. Fifth, the study gathered data through an electronic survey posted on a commercial website that participants could access from anywhere. Thus, the researcher did not have any control over the physical environment where the participants completed the survey, and factors in their physical environments that may have affected participants' responses are not known. Sixth, the dataset had some missing data, which were imputed. Although the study used the best method available for imputing data, the imputed data could have affected the accuracy of the results. Seventh, a numbers of indicators were eliminated from the model either because they showed low loading on factors, or because standardized residuals showed high covariance. This fact narrowed the scope of the constructs. Some of the items on the scales used negative wording and were reverse coded. The literature suggests that reverse coded items can create problems for model fit, which some of them actually did. Eight, the scales measuring different constructs had an unequal number of items. For instance, the competency scale had 39 items; whereas the scale measuring task type had only 6

items. Different Likert scales have been used with different scales (e.g. competency instrument vs. goal orientation). The reason for this was that, for instance, the permission on the competency instrument has been obtained under the condition that the instrument would be used as it is. Ninth, the study did not test some of the hypotheses on mediating effects of some of the variables because the variables were not entered into the structural equation model.

Recommendations for Future Research

Future researchers might explore knowledge withholding in distance education students, though the number of those reporting knowledge withholding is small. Researchers might wish to find out what creates barriers for knowledge sharing in virtual learning teams in distance education. What types of knowledge might virtual learning team members choose to withhold? Do they withhold knowledge because they place value on it? Do they withhold knowledge because in their estimation it has low quality? These questions have been addressed in organizational research, but not in the context of virtual learning teams in distance education.

In addition, future researchers may be interested in further exploring interpersonal trust because it was not confirmed in the VLT framework. What could be the reason? Is it because VLTs come together for such a short period of time? Another question that arises is, What can be done in VLTs to encourage the development of trust? The list of competencies used in this study is not exhaustive, and it could be expanded by identifying more indicators for the validated factors and more factors for the competency framework. This could be an area of exploration for future research.

Social presence in VLTs needs to be explored further. Although several suggestions have been made for creating social presence in virtual classrooms, it would be interesting to study

which of those means are used most by learners, and which ones learners themselves find more important for successful interaction.

The learning community concept in virtual learning teams should also be studied further. Exactly what expectations do VLT members in distance education have of their VLT? Which ones are most important and which ones are least important?

It was beyond the scope of this study to explore the task types that different majors (e.g., business, education, and health and nursing) used. It might be interesting to explore the task types used by different majors and the extent to which they relate to knowledge sharing in VLTs. This research covered only a small set of questions about satisfaction. More research should be conducted to identify what satisfies and/or dissatisfies individual VLT members in distance education as a basis for designing more satisfactory instructional interventions. As discussed earlier in the paper, while learning goal orientation, satisfaction, and instructor strategies have not been confirmed for the validated knowledge sharing model together with the other subconstructs, their statistically significant positive relationships with knowledge sharing were identified. Future research might focus on identifying other predictors for knowledge sharing that can be included in the knowledge-sharing model together with these variables.

A number of other factors that have not been included into this model can also be promising to investigate. This study did not include factors such as team size, instructor's facilitative role, likelihood that students will or will not work with each other again and so on. For instance, in organizational research one of the sub-constructs for team effectiveness is turnover (Cohen & Bailey, 1997). Also, teams members in corporate setting can expect to work on assignments with each other again. In distance education, slim are the chances that students will take a course together with one another again, and it would be interesting to explore the

dynamics in VLTs where students have prior experience of working together vs. VLTs where students do not have such experience. Research can explore these areas too. Additionally, the knowledge sharing validated model should be tested at different educational institutions and with different student populations for validity purposes. Further, this study explored only one direction of relationships among the variables in the model. However, the model of triadic reciprocal causation provides possibilities for exploring other directions as well. This could be done in future studies by redesigning the instruments so that the desired focus could be obtained.

Some refinements that can be done to this study seem to be as follows. Instruments with more items for measuring task type (interdependence) should be located so that the researcher has flexibility of selecting items with higher loadings for the task type model. This will also produce high reliability coefficient for the selected scale, which in the case of this study was not too high. A pilot study with more participants should be designed, and the instruments should be validated before sending them to the participants of the main study.

Conclusions

This study determined that not all the hypothesized constructs have a statistically significant predictive relationship with knowledge sharing if entered together into the model. It developed and validated a VLT knowledge sharing model comprised of five out of nine hypothesized variables (knowledge sharing, VLT competencies, expectation of learning, social presence, task type, and knowledge sharing), and explored the direct, indirect, and total effects that the predictor variables had on knowledge sharing. The VLT knowledge sharing model yielded the same structure when analyzed with groups with different characteristics.

In summary, an understanding of knowledge sharing behavior is essential for successful knowledge management in VLTs. However, this area still needs to undergo considerable

research. This study can guide ongoing research efforts in this area; and the VLT knowledge sharing model can be expanded with more variables that may impact knowledge sharing in VLTs. As a result, educators will make more informed judgments about which factors to focus on while designing VLT interventions.

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Dr. Ruzanna Topchyan

AREAS OF TECHNICAL EXPERTISE

o   Instructional Design, Development, Evaluation & Research
o   Organizational Leadership & Project Management;

o   Classroom / Online Instruction
o   Technology: MS Office; ADOBE; SPSS; AMOS; STATA, R, ANGEL; BLACKBOARD; WebCT: other Online Learning Systems (OLS)

PROJECT EXPERIENCE HIGHLIGHTS

Instructional Design, Development & Evaluation – Designed: different instructional models, English Language summer school model and curriculum, teacher training projects, university level course syllabi, learning assessment instruments, operational manuals, course, program and organizational evaluation/analysis packages. Managed eight educational research projects two of which large scale.

Organizational Leadership & Project Management – Became a co-founder, vice-president and president of the educational non-for-profit organization. Held organizational leadership, managed operations, projects, events schedule and organizational budget. Oversaw organizational assessment, membership management, interviewing, hiring staff and teachers, supervision of administrative staff, meetings with membership and stakeholders, five-year strategic planning, planning of staff and membership professional development and reporting.

Classroom Instruction – Taught university and college level courses in physical and virtual classrooms**:**
Quantitative Reasoning for Business (QRB/501); ESL, English for General Academic Purposes- EGAP;
English for Specific Purposes - ESP (majors: law, public health, industrial engineering, MBA); Test of English as a Foreign Language (TOEFL) & Academic Writing; General English (GE); Communicative Armenian;
Communicative Russian; Writing-105; Basic Composition.