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Towards Improving Collaboration Success in Virtual Teams Through Collaboration Training

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TOWARDS IMPROVING COLLABORATION SUCCESS IN VIRTUAL TEAMS THROUGH COLLABORATION TRAINING

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Summary

Over the last decade the defining factors and motivations behind how we work have significantly and steadily moved toward a globalized network which encourages the sharing and creation of knowledge and information. Due to the nature of this evolution the processes within organizations are now often executed by “virtual project teams” (Dustdar & Gall, 2002). Virtual teams are “groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks” (Tarmizi et al., 2007). The ability to work in a virtual team and effectively collaborate in distributed settings is an important and necessary skill set for today’s knowledge workers to be effective in their work due to the growing use of virtual teams (Duivenvoorde, Briggs, Kolfschoten, & de Vreede, 2009).

Given the varying nature of collaboration tasks, virtual teams and the growing reliance on communication and collaboration technologies available, there is a need for a proven training program for novice practitioners which prepares them in conceiving and employing structured collaboration processes, while establishing strong relational links with teammates, resulting in improved overall collaboration success of the virtual team. The training program should also be flexible across platforms, theory based, and learner focused. Considering the aforementioned requirements, a collaboration training program requires the following key characteristics.

In this research, we have built a collaboration training program that demonstrates the above mentioned characteristics. The training program proposed in this research combines proven relational link development techniques and proven collaboration process structuring techniques from the field of Group Decision Support Systems (GDSS), in such a way as to provide practitioners with useful processes for structuring collaboration activities in virtual teams. These techniques are specifically tailored for practitioners with limited online collaboration experience through explanation and attention paid to program feasibility.

The overall research question for this study is:

In the context of swift-starting virtual teams, does the use of a pre-collaboration training program lead to increased relationship development among team members and better process structuring in collaboration projects, which in turn leads to improved collaboration success outcomes?

In order to answer this research question, several hypotheses related to relational link development, process structuring and collaboration success have been developed and tested. The evaluation of the hypotheses involved a pilot study and an extended study, which were conducted based on surveys among students in several distance learning courses. The significance of this research question is important toward understanding the relationship between virtual team collaboration training and collaboration success. This research contends that a successful training program will benefit an organization through providing knowledge workers with specific knowledge, skills and techniques to successfully collaborate in a virtually distributed environment. This research also deals with collaboration success outcomes, which is an important issue due to the increasing utilization of virtual teams among standard business practices.

Our findings are important toward developing a better understanding of the impact of process structuring and relational link development on the collaboration success of a virtual team. One of the key findings within this study is that there is a significant relationship between the collaboration training program and increased instances of relational link development and process structuring. These findings were consistent in the pilot study as well as the extended study. Having established that the collaboration training program does in fact increase instances of relational link development and process structuring in novice practitioners the next step was to evaluate how these developments impacted the outcome of collaboration success of the collaboration task. We were able to establish that the increased instances of relational link development had a significant relationship with collaboration success. We were not able to establish that increased instances of process structuring had a significant relationship with collaboration success.

These findings contribute to the body of knowledge in two primary research fields. First, the field of Group Decision Support Systems (GDSS) provides the building blocks for the process structuring and facilitation techniques utilized within this study. GDSS research began with the utilization of a collaborative software tool, which was used by a professional facilitator, to focus and structure collaborative activities. Out of this research came the field of Collaboration Engineering (CE). Collaboration Engineering is an approach to designing collaborative work practices and deploying those designs for practitioners to execute without the support of a professional facilitator (Briggs, 2006). Traditionally the tools and techniques found within this body of work have focused on the face-to-face traditional collaborative environment. This research contributes to the body of knowledge in GDSS research by evaluating the application of CE techniques within distributed collaborative environments. The second body of knowledge to which this research contributes is Online Education. Within this field there are multiple approaches and techniques which have been applied and evaluated which look to improve and understand the collaboration process and outcomes. The unique aspect of this research is that it looks to bridge the body of knowledge between Group Decision Support Systems and Education.

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CHAPTER 1

Introduction

Over the last decade the defining factors and motivations behind how we work have significantly and steadily moved toward a globalized network which encourages the sharing and creation of knowledge and information. Advancements in communication and network technologies have provided the means for organizations to overcome the barriers of time, space and location (Prasad & Akhilesh, 2002). Organizational strategies have specifically been impacted by the globalized network through global expansion, increases in foreign-based subcontracting of labor, telecommuting and increased pressure to quickly and economically produce and market their products and services (Jarvenpaa & Leidner, 1999). Due to the nature of this evolution many processes within organizations are now often executed by "virtual project teams" (Dustdar & Gall, 2002). Virtual teams are "groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks"(Tarmizi et al., 2007, p. 80). In a 2004 survey by the Gartner group, they found that more than 60% of professional employees work in virtual teams. (Martins, Gibson, & Maynard, 2004). Virtual teams are utilized for many processes including product development, computer support and test centers (Prasad & Akhilesh, 2002). Several well known organizations have trended toward relying on virtual team utilization and execution. VeriFone, a multinational company, has been reported to rely on teams that interact virtually to run its business (Jarvenpaa & Leidner, 1999). Microsoft utilizes virtual teams to support major global and corporate sales and service. Motorola also has multiple teams working together from different parts of the globe on a single product (Prasad & Akhilesh, 2002). One benefit of virtual team utilization is the ability for organizations to exploit information and communication technologies to leverage diverse competencies and skills to solve complex problems from around the world (Prasad & Akhilesh, 2002). Virtual teams also allow for the potential of greater innovation because of the increased diversity in those participating in

product and process creation (Prasad & Akhilesh, 2002). Virtual team collaboration has also been shown to improve learning efficiency and facilitate critical thinking and communication skills (Tseng, Ku, Wang, & Sun, 2009).

While there are many potential benefits to virtual team collaboration, there are also significant difficulties faced by these teams which can negatively impact the effectiveness of the virtual team. While many of the difficulties found in virtual teams are similar to face-to-face teams, there is an added complexity through the reliance on technology to overcome physical distance and time disparity (Prasad & Akhilesh, 2002). These complexities can impact a) team member satisfaction (Beranek & Martz, 2005), (b) coordination and communication effectiveness (Pinsonneault & Caya, 2005), (c) development of trust amongst team members (Beranek & Martz, 2005), (d) and team member expectations (Powell, Piccoli, & Ives, 2004).

The ability to work in a virtual team and effectively collaborate in distributed settings is an important and necessary skill set for today's knowledge workers (Duivenvoorde et al., 2009). In order for knowledge workers to establish the necessary skill sets to overcome difficulties inherent to virtual collaboration, they need specific techniques and processes which are feasible for them. Within the current body of research there are a vast number of theoretical developments deemed important to the creation, use, application and outcomes of virtual teams (Martins et al., 2004). There are two areas within current research which have the potential to give knowledge workers techniques to overcome the difficulties faced in virtual team collaboration. These areas are *process structuring* and the *development of trust through relationship building*. Previous research indicates that teams' processes and team members' relations presented the strongest relationships to effective team performance and team satisfaction (Lurey & Raisinghani, 2001). Several studies (Beranek & Martz, 2005; Furst, Blackburn, & Rosens, 1999; Iacono & Weisband, 1997; Jarvenpaa & Leidner, 1999; Powell et al., 2004) discuss the benefits, difficulties and effect of lack of trust in virtual teams. These studies cite the importance of trust toward the effectiveness of virtual teams. Knowledge workers also need to employ formally structured processes to ensure efficient and effective performance of virtual teams (Lurey & Raisinghani, 2001). In an evaluation of group

processes of swift-starting virtual teams found that it is necessary for effective swift-starting virtual teams to structure their interactions, including process structuring activities such as discussing project goals and deliverables, defining roles and responsibilities and setting milestones (Munkvold & Zigurs, 2007). Swift-starting virtual teams have been characterized as technology intensive and primarily short term due to the nature of technology and their rapid start-up (Tarmizi et al., 2007). Difficulties with formalizing a structured process and establishing relationships in a swift-starting virtual team are further complicated by the varying nature of collaboration tasks and the inherent inability for communication technologies to have enough depth to convey emotions necessary to establish relationships amongst team members (Warkentin & Beranek, 1999). It is evident that knowledge workers need the ability to structure tasks and develop trust in virtual teams in order to overcome difficulties, resulting in improved collaboration outcomes. This study posits that knowledge workers can acquire these abilities through a collaboration training program focused on this very goal.

Given the varying nature of collaboration tasks, virtual team, and the growing reliance on communication and collaboration technologies available, there is a need for a proven training program for novice practitioners which prepares them to conceive and employ structured collaboration processes, while establishing strong relational links with teammates, resulting in improved overall collaboration success of the virtual team. The training program should also be flexible across platforms, theory based and learner focused. Three key bodies of knowledge are relevant to this research which focuses on the topics inherent to virtual team research. The first area of research focuses on topics such as, “trust, communication, participation, coordination and effectiveness” (Tarmizi, Vreede, & Zigurs, 2006). A second body of knowledge focuses their evaluation on the impact of relational link development on virtual team outcomes. (Beranek & Martz, 2005; Bradley, Haines, & Vozikis, 2002; Iacono & Weisband, 1997; Jarvenpaa, Knoll, & Leidner, 1998; Jarvenpaa & Leidner, 1999). A third body of knowledge focuses on the application of process structuring, but with limited attention to relational link development, in multiple environments including face-to-face and distributed (Briggs, de Vreede, & Nunamaker , 2003; Kolfschoten & de Vreede, 2007;

Kolfschoten, de Vreede, & Pietron, 2006). This body of knowledge focuses on two key areas: Group Decision Support Systems (GDSS) and Collaboration Engineering (CE). This body of knowledge began with the utilization of a collaborative software tool to facilitate a collaborative activity. The research within GDSS then grew into multiple areas, including Collaboration Engineering. CE looks to overcome the difficulties faced within the implementation of a GDSS system and process. One of the fundamental research contributions made within CE is the development and the evaluation of process structuring techniques. There is also a single research study which is also relevant to this research. A relatively recent study by Tarmizi et al. (2007) evaluates the impact of both process structuring and relational link development in a distributed environment. Interestingly, the researchers found difficulty in the administration of processes in this environment and offered the suggestion of "pre-training" virtual team membership with the end effect of possibly encouraging team members to think differently about virtually collaborating and teaching them specific things to which they need to pay attention. For this research, we argue that the need is not for a "pre-training" program, but a pre-collaboration training program because knowledge workers need to develop the knowledge and utilization of virtual team collaboration before they are required to implement them.

Considering the aforementioned requirements, a virtual team collaboration training program requires the following key characteristics.

It should

1) provide relational link development skills for novice practitioners
2) provide basic process structuring skills for novice practitioners
3) be flexible across modes and channels of communication
4) have a strong theoretical grounding
5) have a learner focus

This research builds and tests a collaboration training program that demonstrates the above mentioned characteristics. The first two key characteristics are related to the

development of relational link skills among team members and process structuring skills in novice practitioners. The training program proposed in this research combines proven relational link development techniques and proven collaboration process structuring techniques in such a way as to provide practitioners with useful processes for structuring collaboration activities in virtual teams. These techniques are specifically tailored for practitioners with limited online collaboration experience through explanation and attention to program feasibility. The third key characteristic of the training program is that it is flexible across multiple collaboration modes and channels. It can be considered to be flexible across collaboration platforms on two independent levels. First, the training materials can be distributed using any available means of technology. For example, it is possible to use Microsoft OneNote or any word processing program to outline and distribute material. Second, the training program and collaboration tasks can be administered using different telecommunication technologies. The only requirement for the training program is the ability to send and receive training materials and perform corresponding activities. The subsequent collaboration task(s) can then be administered utilizing any processes and technologies readily available. The fourth key characteristic is that it should have a strong theoretical foundation. Past research provides the body of knowledge which was reviewed and synthesized to create the theoretical basis underlying the proposed training program. This theoretical basis provides the necessary structure and incorporates proven techniques related to different areas of the training program. Two key theoretical bodies of work considered are (a) the Team Performance model for developing relational links, and (b) the collaboration engineering approach for developing process structure. Also, theoretical work considering collaboration success outcomes has been considered to evaluate the impact of the training program on collaboration outcomes. The fourth key characteristic is that the training program be learner-focused. In order to create a program which is learner-focused, care was taken to utilize proven benchmarks for learning during the development of training program objectives and subsequent activities. These primary characteristics provide further insight into the key contributions of this research.

The overall research question for this study is

In the context of swift-starting virtual teams, does the use of a pre-collaboration training program lead to increased relationship development among team members and better process structuring in collaboration projects, which in turn leads to improved collaboration success outcomes?

In order to answer this research question, several hypotheses related to relational link development, process structuring and collaboration success has been developed. The evaluation of the hypotheses involved a pilot study and an extended study, which were conducted based on surveys among students in several distance learning courses. The significance of this research question is important toward understanding the relationship between virtual team collaboration training and collaboration success. This research contends that a successful training program will benefit an organization through providing knowledge workers with specific knowledge, skills and techniques to successfully collaborate in a virtually distributed environment. This research also deals with collaboration success outcomes, which is an important issue due to the increasing utilization of virtual teams among standard business practices.

In addressing the above mentioned research question, this research makes the following three main contributions: (1) a virtual team collaboration training theoretical model, (2) an instructionally designed training program, and (3) methods for evaluating the training program.

The first key contribution is the theoretical model. The theoretical model builds upon previous research in virtual teams. The theoretical model first explores the impact of the training program on process structuring and relational link development. Secondly, the theoretical model explores the impact of process structuring and relational link development on the outcomes of a collaboration task. The second key contribution of this research is the instructional design of the training program artifact and the artifact itself. The instructional design process utilized proven benchmarks for learning outcomes to establish objectives and

activities for each module within the training program. This contribution is unique in that many training programs do not include this process. The third key contribution of this research is the evaluation of the training program. The evaluation of the training program was two-fold. The first phase of evaluation was to explore the impact of the training program on instances of process structuring and relational link development and to evaluate the feasibility of the training program. The second phase of evaluation was to first explore the impact of training on instances of process structuring and relational link development and then evaluate the impact of this development on collaboration success. The evaluation of the training program also looks to establish continued utilization of the process structuring techniques developed for Collaboration Engineering (CE). Within a traditional face-to-face environment these techniques have provided support and structure to a collaborative activity resulting in increased group productivity and decreased process losses. This evaluation is vital in that it provides insight into the application of CE techniques in a unique environment. This evaluation contributions to the field of Group Decision Support Systems (GDSS) and CE by first providing insight into the application of the techniques in such an environment and also providing methods and instruments for future work in this area.

The remainder of this study is structured as follows. Chapter 2 reviews related literature in the areas of virtual teams, collaboration engineering and collaboration success factors. Chapter 3 provides the framework of the proposed training program, followed by details about the program. Chapters 4 and 5 describe and review a pilot study of the proposed training program. Chapter 6 provides the design of the extended study of the proposed training program. Chapter 7 provides an in-depth analysis and discussion of the data gathered during the extended study. The study concludes with the contributions and implications of this study, discussed in Chapter 8.

CHAPTER 2

Literature review

In order to effectively employ a unique and theoretically based training program, several areas of research have been evaluated. The first key research area focuses on characterizing virtual teams and the factors which present difficulties to virtual team collaboration. These difficulties warrant the need for further research and the potential for a training program based on successful collaboration techniques. The second key research area for the proposed training program includes collaboration techniques studied as part of Collaboration Engineering research and the research which has tested these techniques. Building on this literature review and analysis, a unique collaboration training program has been developed, particularly focused on inexperienced collaboration practitioners. This chapter begins by exploring the following aspects of virtual teams: inherent difficulties, relational link development, process structuring, theory development and utilization and the Team Performance Model (TPM). The chapter builds upon this discussion to transition to the following key aspects of Collaboration Engineering: Collaboration Engineering for process structuring and the Collaboration Engineering design approach. Lastly we discuss collaboration success factors.

Virtual Teams

While there are varied definitions for what constitutes a virtual team, most researchers agree on the following three key attributes for virtual team members: 1) members are responsible for individual tasks guided by a common purpose, 2) members must rely on some form of communication technology more than face-to-face interaction, and 3) members are likely geographically dispersed from each other (Schiller & Mandviwalla, 2007). This research adheres to the following definition by Maznevski and Chudoba (2000) that captures these attributes. A virtual team is defined as a group of people who interact through

interdependent tasks guided by common purpose and work across, space, time and organizational boundaries with links strengthened by webs of communication technologies (Maznevski & Chudoba, 2000). While it is relatively simple to define a virtual team, it is much less simple to understand the vast bodies of knowledge which explore virtual teams. One of the inherent difficulties toward understanding virtual teams lies in the number of theories and topics deemed important to the creation, use, application and outcomes of virtual teams (Martins et al., 2004). This research explores the theories and concepts of three key topics in virtual team research: difficulties inherent to virtual teams, theoretical foundations for virtual team research, relational links and process structuring.

Difficulties Inherent to Virtual Teams

One of the most important topics to thoroughly analyze when first exploring virtual team research is the difficulties which are inherent to virtual teams. While many of the difficulties found in virtual teams are similar to face-to-face teams, there is an added complexity through the reliance on technology to overcome physical distance and time disparity (Prasad & Akhilesh, 2002). Within the very definition of a virtual team there are several overlapping causal characteristics which impact the collaboration success of virtual teams: reliance on communication technologies, geographical dispersion and lack of time, and space organizational boundaries. In a study by Powell, Piccoli and Ives (2006) researchers explore literature to provide insight into the difficulties/issues consistently found in virtual team research. Table 1 summarizes the difficulties from Powell's study as well as supplemental issues from additional studies.

Table 1: Virtual Team Characteristics and Difficulties (adapted from (Powell et al., 2004))

Characteristic	Resulting Difficulties & Studies:
Reliance on Communication Technologies	o Varying levels of technical expertise which negatively impacts individual team member satisfaction (Kayworth & Leidner, 2000; van Ryssen & Godar, 2000, Munkvold & Zigurs,2007). o Lack of norms for communication resulting in coordination and communication difficulties (Munkvold & Zigurs,2007) o Lack of depth of media to convey emotion and nonverbal communication partially hindering the development of relationships (Sproull & Kiesler, 1986, Sproull & Kiesler, 1991, Burke & Chidambaram,1996; McDonough et al., 2001; Warkentin et al., 1997)
Geographical Dispersion	o Lack of common frame of reference causing communication breakdowns (Crampton,2001; Mark, 2001) o Unpredictability of team members, such as extended absence causing coordination breakdowns (Crampton, 2001; Sarker & Sahay, 2002; van Ryssen & Godar, 2000).
Inexistent Time/Space boundaries	o Time delays causing communication breakdowns (Crampton, 2001; Mark, 2001) o Time differences restricting the possibility of synchronous interaction (Munkvold & Zigurs, 2007).
Cultural Differences	o Coordination difficulties (Johansson et al., 1999; Kayworth & Leidner, 2000; Maznevski & Chudoba,2001; Robey et al., 2000, Munkfold & Zigurs,2007) o Ineffective communication (Kayworth & Leidner, 2000; Sarker & Sahay, 2002; van Ryssen & Godar, 2000)
Swift-starting	o Not enough time to develop trust (Jarvenpaa & Leidner,1999) o Mismatches in expectations (Munkvold & Zigurs, 2007)

The list in Table 1 is not exhaustive, but it does provide a general overview of the key difficulties found in virtual teams. The very goal behind this research is to overcome these difficulties in an effective and efficient manner. Through an investigation into several studies, two key concepts were consistently utilized to overcome said difficulties: the development of relational links and the structuring of team processes.

Relational Link Development

A number of the theories within virtual team research focus on the socioemotional aspects of a team. This includes the development of relational links. Developing relational links consists of performing activities related to the well-being of the group and individual members. Relational link development fosters and maintains the occurrence of trust in virtual teams. Relational links can be developed through such steps as defining member roles and establishing consistent patterns of communication (Warkentin & Beranek, 1999). Establishing relationships within virtual team members has proven to be challenging (Warkentin & Beranek, 1999). The difficulties of establishing relational links in virtual teams relates back to the characteristic of a virtual team. First, the development of relationships and trust between team members is directly and negatively impacted by the sole reliance on computer-mediation (Prasad & Akhilesh, 2002). In face-to-face groups the development of relational links are quickly and easily established through non-verbal cues such as facial expressions and tone of voice. These cues can quickly stimulate conversation, convey meaning, and drive agendas. Second, virtual teams are often swift-starting. The development of relational links is a challenge because ad-hoc and swift-starting groups do not have time to develop relational relationships. Team members will also often focus on task activities and exclude relational link development (Munkvold & Zigurs, 2007). Some recent research does offer the suggestion that if virtual teams are given team communication training, they will develop relational links stronger than teams which do not receive training (Warkentin & Beranek, 1999). Why is the establishment of relational links and trust important? The importance of these two factors directly relates to their impact on virtual team processes and outputs. Trust can increase confidence and security within team member relationships and encourage an environment in which information can be open and freely exchanged (Jarvenpaa & Leidner, 1998). Virtual teams that exhibit high trusting behaviors experience significant social communication as well as predictable communication patterns, substantial feedback, positive leadership, enthusiasm, and the ability to cope with technical uncertainty (Jarvenpaa & Leidner, 1999). The inability for virtual teams to freely exchange information can and more than likely will negatively impact team performance. A study by Weisband (1997) found that swift-trust development in

virtual teams was one of the key predictors toward higher performing teams. The challenge for this research was to find theories to provide a framework for training teams on building relational links in a virtual team.

Process Structuring

Another path toward understanding virtual teams focused on the processes utilized by these teams and the impact this process had on collaboration success. In studying team effectiveness, Lurey and Raisinghani (2001), identified three core criterions towards an effectiveness framework: team performance, work process and individual team member satisfaction. This study shows that in order to evaluate virtual team performance it is important to assess the impact of work processes on the outcomes of collaboration. Work processes are the structural elements utilized within virtual teams to complete tasks. Work processes can include process development and task structure (Munkvold & Zigurs, 2007). Due to the difficult nature of virtual teams, these teams require more structure to perform their work (Lurey & Raisinghani, 2001). The assumption often is that individuals within a group have the inherent ability and skills necessary to work as a group to structure tasks and develop processes toward successful completion of a group goal. The development of relational links and process structuring within virtual teams have each been shown to have an impact on the work processes of a collaboration activity (Munkvold & Zigurs, 2007). Work processes then in turn can impact the outcomes of collaboration. To this point in our research we have established the difficulties inherent to virtual teams and two supported concepts for overcoming said difficulties. Once this was completed it was important to look to established theories which support these concepts in order to build a framework for our training program.

Theoretical Foundations of Virtual Team Research

While there are a number of theories related to virtual team research, the literature suggests three primary categories of virtual team operations: inputs, task processes and outputs. Powell et al. (2004) defines these three categories in their review of virtual team

literature. They identify inputs as, “the design and composition characteristics of a virtual team and the endowment of resources, skills and abilities with which the team begins its work.” Task processes are the processes that occur as a virtual team works toward accomplishing a task or goal. Processes can further be classified into planning processes, action processes and interpersonal processes (Martins et al., 2004). Outputs, or outcomes, are centered on the performance or effectiveness of the team, including satisfaction with the virtual team experience.

Table 2: Use of theories in Virtual Team Research (adapted from (Schiller & Mandviwalla, 2007))

Team Inputs	Team Processes	Team Outputs
Members: o “Big Five” personality model o Dialogue theory Context: o Adaptive Structuration theory o Contingency theory o Control theory o Learning theory o Media richness theory o Network and organization form theory o Role theory o Self-efficacy theory o Social identity theory o Social informational processing theory o Team performance model o Time, Interaction, and performance theory	Communication: o Adaptive Structuration theory o Media richness theory o Task-media fit theory o Team knowledge transfer model o Time, interaction and performance theory Social interaction: o Adaptive structuration theory o Big Five personality model o Conflict management behavior theory o Control theory o Dialogue theory o Media richness theory o Network and Organization form theory o Punctuated equilibrium model o Self-efficacy theory o Social comparison theory o Social identity or deindividuation theory o Social information processing theory o Social presence theory o Swift trust theory o Team performance model o Time, interaction and performance theory	Task performance: o Adaptive Structuration theory o Business action theory o Contingency theory o Dialogue theory o Media richness theory o Network and organization form theory o Social information processing theory o Task circumflex model o Task-media fit theory Effectiveness o Adaptive structuration theory o Business action theory o Commitment theory o Conflict management behavior theory o Dialogue theory o Learning theory o Media richness theory o Media synchronicity theory o Punctuated equilibrium model o Self-efficacy theory o Social information processing theory o Task circumflex model o Time, interaction, and performance theory

Schiller and Mandviwalla (2007) use this fundamental categorization to further explore the most widely used theories in virtual team research. They found 14 theories widely

used as theoretical foundations for team input research, 22 theories for team process research and 22 theories for team outputs research (Table 2). Notice that there is overlap within this categorization of a theory.

The top 5 most widely used theories within virtual team research are adaptive structuration theory, media richness theory, social information processing theory, social presence theory and time, interaction and performance theory. The adaptive structuration theory (AST) is based on Giddens (1989) structuration theory. AST looks at the impact of the use of technology as a communication medium on the development of groups. Of importance to this theory is that one of the main goals of groups is to adaption to the situation they are in. Media richness theory (MRT) is primarily concerned with media preferences and usage in organizational settings. MRT suggests that communication media can be ranked on a richness continuum based on their ability to handle equivocality and uncertainty (El-Shinnawy & Markus, 1997). Social information processing (SIP) theory proposes that computer-supported groups will take longer to exchange information than face-to-face groups (Schiller & Mandviwalla, 2007). The end result is a negative impact on the development of relationships in groups. Social presence theory (SPT) also relates to the exchange of socioemotional information toward the development of relationships in virtual teams. SPT suggests that the lack of visual and auditory clues in computer-mediated communication will negatively impact the exchange (Schiller & Mandviwalla, 2007). MRT and SPT are similar in that they focus on the inability of computer-mediated groups to share socioemotional information needed develop trust, warmth and other interpersonal affections (Warkentin & Beranek, 1999). The time, interaction and performance (TIP) theory proposes that member-support and group well-being functions need to be involved in order for groups to develop relational links. In this theory group members are expected to act in four modes and three functions. The four modes are inception (goal choice), problem solving (means choice), conflict resolution (policy choice), and execution (goal attainment). The three functions are production, well-being, and member support. One noted benefit to this theory is that it can be utilized to evaluate virtual teams throughout their lifecycles (Schiller & Mandviwalla, 2007). This brief overview of virtual team theoretical foundations again supports that one of the inherent difficulties toward

understanding virtual teams lies in the vast number of theories and topics deemed important to the creation, use, application, and outcomes of virtual teams (Martins et al., 2004).

As the research demonstrates there are a number of difficulties inherent to virtual teams. These difficulties have been studied vigorously resulting in the development of several theoretical foundations. Due to the number of difficulties and theories associated with virtual teams it was important for this research, and more specifically for the development of a training program, to focus on uniquely combining aspects of theories which can be utilized by knowledge worker to overcome difficulties within their control. Items out of the control of the knowledge worker can include team design, instructional delivery, and technology. The two areas which knowledge workers can directly impact difficulties are relational link development and the structuring of team processes. These studies examined five theories most widely used and evaluated additional theories to find a basis for our relational link and process structuring development framework. This study then defines an evaluative framework based on the third category of theories, team outcomes.

Team Performance Model

Upon careful consideration many of the theories utilized in virtual team research, including the top five, many of them focus heavily on the socio-emotional factors of virtual teams with limited mention of specific team processes or structure. Many of them also specifically focus on issues related to communication technologies. To this end, there was one theory which provided both relational link support and process structuring support with no mention of the added component related to communication technology. This research specifically aimed to create a training program which was platform independent. To develop a framework for training virtual teams on building relational links in a virtual team this research heavily relied on the Team Performance Model (TPM), Figure 1, proposed by Drexler, Sibbet, and Forrester (1988). The TPM is a widely used model which looks at team performance. There are seven stages in the TPM model. These stages are orientation, trust building, goal clarification, commitment, implementation, high performance and renewal. Each stage

provides steps in the team-building process which are important to both the outcome of the meeting as well as the relationship outcome.

Figure 1: Team Performance Model. Adapted from (Drexler, Sibbet, & Forrester, 1988).

Notice that there are two stages to the model. The first stage is the *creating stage*. During this stage the team members get to know one another through introductions and developing a common understanding of other group members. Within this stage members define the task (Drexler, Sibbet, & Forrester, 1988) and further determine how to break the task up into steps if needed, defining task roles and establishing norms (Warkentin & Beranek, 1999). At some point within this stage a team leader may also be identified. Within the creating stages there are building blocks in which the team can move back and forth between until accomplishing their goal. Each block has a specific goal and lists the benefits and difficulties faced when each goal is resolved or unresolved. The first block is *orientation*. Within this block it is important that each team member establishes why they are there, how they will fit, and whether others accept them. If this block is resolved team members can feel a sense of purpose, team identity and membership. If unresolved, team members can exhibit disorientation, uncertainty, and a sense of fear. The second building block is *trust building*.

Team members establish a sense of who they are working with through shared expectations and competencies. If resolved, team members will feel a sense of mutual regard, forthrightness and reliability. If unresolved, team members will feel caution, mistrust and facade. The third block is *goal clarification*. During this block team members begin working on more tasks devoted to outcomes verses focusing on relation links. Teams often establish priorities at this time. If resolved teams will exhibit explicit assumptions, clear, integrated goals and shared vision. If unresolved, teams will exhibit apathy, skepticism and irrelevant competition. The fourth block is *commitment.* This block falls between the creating and sustaining stages. Within this block groups need to begin making decisions about how resources should be managed. If this block is resolved, roles will be assigned, resources will be allocated and decisions will be made. If unresolved, teams will feel resistance.

From the commitment block the groups will transition into the *sustaining stage*. The first block in the sustaining stage is *implementation.* The team begins to decide who does what, when and where. If resolved a clear process is developed alignment is made and a sense of discipline is give toward group execution. If unresolved, teams will exhibit conflict/confusion, nonalignment and missed deadlines. At this point teams may also revisit the creating stage if they feel any sense of unresolved processes. The second block in the stage is *high performance*. During this block a team can change its goals and respond to various changes. If resolved a team will exhibit spontaneous interaction, synergy and may surpass results. If unresolved they may feel a sense of overload and disharmony. At this point teams may also return to the creating stage to resolve any issues necessary. The last block in this stage is *renewal*. At this point teams need to establish why they should continue. If resolved teams can feel recognition and celebration and a sense of staying power. If unresolved they may feel boredom or burnout. While this may be the last block, it is not necessary the last step toward task completion. Groups may revisit any block necessary throughout the project to develop a sense of shared understanding. Within this model there are instances of relational link development and process structuring.

Virtual team research has several key theories which focus on the interplay between the utilization of collaboration technologies in virtual teams and the relationship development

within these teams to overcome difficulties inherent to virtual teams. The TPM model supports the development of a training program which includes the development of relational links and process structuring in virtual teams. Ultimately what is of utmost importance to the theoretical development and evaluation of virtual teams is how these developing factors impact collaboration success.

To summarize this section on virtual team research, the first review explored the difficulties inherent to virtual team research. The review of this area revealed that the difficulties inherent to virtual team warrant a need for techniques to overcome these difficulties. Two key concepts were found which can be utilized to overcome these difficulties. These two concepts were the development of relational links and process structuring. The review then focused on current literature to establish an appropriate theory to utilize as a framework to support these concepts in the building of a training program. Based on this review, the framework chosen was the Team Performance Model (TMP). While the TMP does provide theoretical support for team processes, it does not specifically provide a structured set of techniques for the development of team processes. Based on this, and a review of process structuring in collaboration tasks, Collaboration Engineering (CE) was chosen as the framework for the establishment of process structuring. The following discussion explores Collaboration Engineering, a facilitation technique with demonstrated success, for establishing the development of process structuring in the proposed training program.

Collaboration Engineering (CE) for Process Structuring

The skills necessary to properly facilitate a collaboration activity are not inherent to most individuals. These skills are crucial because many collaboration activities can be successful when facilitated properly. Facilitators of a collaboration activity can rely on their knowledge of group dynamics, formalized process structuring techniques and technology to conduct group tasks (de Vreede & Briggs, 2005). One of the key goals of this research is to find established approaches or techniques which can be utilized to help foster facilitation

skills in the novice practitioner. The novice practitioner can then utilize these skills to facilitate a collaboration activity. An exploration of previous research focusing on collaboration and facilitation revealed a large body of knowledge within Group Decision Support Systems (GDSS) with regards to the facilitation of collaboration tasks.

Within a GDSS environment professional facilitators are extensively trained and utilized to guide novice groups through collaboration activities through the utilization of prescribed process structuring techniques. Typically they can learn how to manage a GDSS system in a few days, whereas it can take a year or more to truly understand how the features can be utilized effectively in the service of group dynamics (Briggs et al., 2003). Processional facilitators can move a group through a collaboration process more efficiently and effectively than if a group is left to its own devices (de Vreede & Briggs, 2005). The results of this facilitation are a decrease in project completion time and an improvement in results. Facilitators who effectively use collaboration technology tools were found to save 50% to 90% of project time, while at the same time improving the deliverable (de Vreede & Briggs, 2005). The difficulty lies in the fact that the utilization of professional facilitation can prove to be expensive, difficult to maintain and difficult to find (Briggs et al., 2003). Professional facilitators are also often not utilized in routine or daily activities. Organizations recognize the benefit of facilitation, but need a method to improve its feasibility. Collaboration Engineering seeks to provide organizations with the benefits of professional facilitation through the use of available resources. “Collaboration Engineering is an approach to the design of reusable collaboration processes and technologies” (de Vreede & Briggs, 2005). Collaboration engineering can be utilized to bring the value of facilitation to people who would not otherwise have access to facilitation.

Collaboration Engineering is an approach to provide structured facilitation to collaboration tasks. As developed, this approach focuses on specifically trained individuals as facilitators to create a prescribed process for practitioners. Facilitators trained on proper application of the collaboration engineering approach are deemed collaboration engineers. This process is then transferred from the facilitator to the practitioner. Practitioners typically do not have prior knowledge or significant knowledge of group dynamics or formalized

structured processes for collaboration tasks. Collaboration engineers are used to provide group processes and structure for recurring activities before the collaboration activity. Once they have completed this task, they are no longer a part of the collaboration process. “In Collaboration Engineering the collaboration engineer designs a reusable and predictable collaboration process prescription for a recurring task, and transfers the prescription to practitioners to execute without the intervention of group process professionals,” (Kolfschoten & de Vreede, 2007). The belief behind this process is that the practitioner does not need to have an understanding of the process structure or facilitation techniques. This belief is problematic for several reasons. First, not all collaboration activities will have access to structured patterns created by a collaboration engineer. Second, Collaboration Engineering strictly focuses on recurring collaboration tasks; it does not provide a solution for ad hoc tasks. In the virtual team environment the majority of tasks can be deemed ad hoc.

Within the process prescription created by a collaboration engineer is a set of specialized and scripted patterns of collaboration. These patterns, called thinkLets, have been developed in order to achieve Collaboration Engineering goals. The concept of thinkLets has been introduced to reduce the difficulty which practitioners found when trying to facilitate a process prescription developed by a collaboration engineer. Lowry and Nunamaker (2002) first prescribed the general process framework for the application of thinkLets in their work with collaboration writing. A thinkLet is a way to create a pattern of collaboration which contains building blocks for group processes. Essentially, thinkLets are packaged, repeatable, and transferable facilitation techniques that can be deployed to create predictable patterns of collaboration among a group of people with a shared goal, during a collaboration process (de Vreede, Kolfschoten, & Briggs, 2006). Each thinkLet supports one or more of the six general descriptive patterns of thinking in performing an intellectual task collaboratively, namely generate, reduce, clarify, organize, evaluate, and build consensus (Tarmizi et al., 2007). Like design patterns, thinkLets serve multiple purposes in the design and deployment of collaboration processes (de Vreede et al., 2006). They encapsulate best practices in facilitating collaboration processes and thus serve as units of intellectual capital. Thinklets have primarily

been used to design collaboration processes to enable process structuring by collaboration engineers, not practitioners or participants (Kolfschoten & de Vreede, 2007).

Collaboration Engineering Design Approach

Collaboration Engineering aims to provide professional facilitation processes to organizations which previously would not have had access to such facilitation. These processes are created by a collaboration engineer and then transferred to the practitioner. Typically this facilitation occurs for repeatable tasks. Within the field of Collaboration Engineering, researchers have looked at establishing guidelines to support collaboration engineers in their efforts to foster high quality design processes. These guidelines have been organized by Kolfschoten and de Vreede (2007) and termed as the Collaboration Engineering (CE) Design Approach, Figure 2. The primary goals of the CE Design Approach are to provide:

- Support for inexperienced collaboration engineers
- A basis for the creation of design support tools.
- A basis for the training of collaboration engineers.

The CE Design Approach is used as the fundament building block for the process structuring techniques utilized in this study. Kolfschoten and de Vreede (2007) provides a overview of the CE Design Approach (Kolfschoten & de Vreede, 2007). In this approach the steps are not always executed sequentially, but can be repeated as needed.

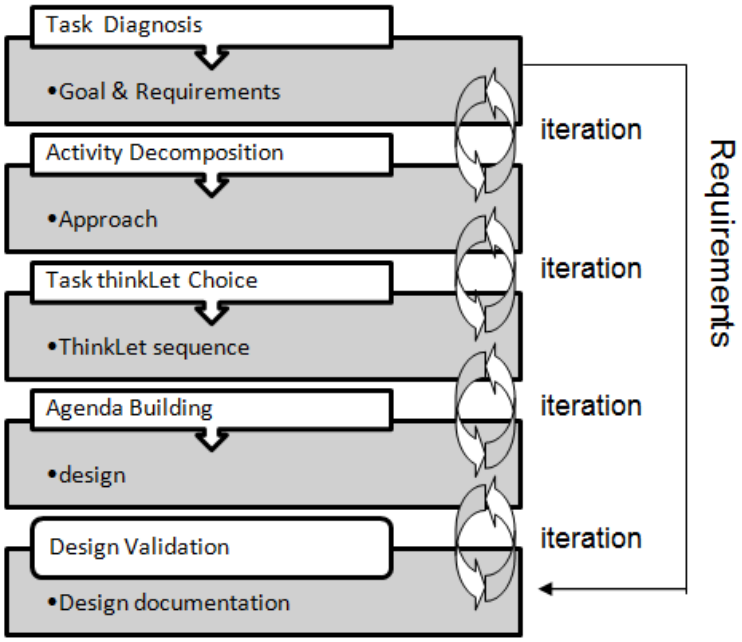

Figure 2: Collaboration Engineering Design Approach (adopted from Kolfschoten and de Vreede (2007)

The first step in the CE Design Approach is *Task Diagnosis*. Within this step the collaboration engineer meets with the stakeholders (individuals involved in the collaboration activity) to determine the requirements and constraints with regards to the task, the stakeholders involved and available resources. The collaboration engineer first determines the goals, deliverables and objectives for the group. The collaboration engineer also completes a stakeholder analysis (group, stakes, roles and needs), resource analysis (time, knowledge, effort and physical resources) and a practitioner analysis (skills, experience, personality and domain expertise). The second step in the approach is *Activity Decomposition*. Within this step the collaboration engineer further analyzes the task into activities and determines the deliverables. After the activities have been analyzed, they are broken down into smaller steps either through process decomposition and/or results decomposition. *Process decomposition* applies the patterns of collaboration to the outlined activities. The patterns of collaboration are: *Generate*, *Reduce*, *Clarify*, *Organize*, *Evaluate* and *Build Consensus*. *Results decomposition* focuses on a specific classification of the end result in order to determine the activities needed during the collaboration process. The classifications include: input, structure,

focus, share understanding, commitment, and empathy. The third step is *Task-ThinkLet Choice*. In this step a collaboration engineer matches each of the activities, based on their pattern of collaboration, a thinkLet. Within this approach, there are numerous thinkLets available for utilization by a collaboration engineer. To simplify the task thinkLet choice, a thinkLet choice map is utilized. It includes precise information about the proper application of each thinkLet. This includes pattern of communication, end result and additional corresponding thinkLets. The fourth step is *Agenda Building*. Within this step a collaboration engineer prescribes the processes for this collaboration activity. The agenda format includes columns for the activity, activity description, question/assignment, deliverable, thinkLet pattern and time. These processes can also include warm-up activities, introduction to technology, breaks or presentations. The last step in the approach is *Design Validation*. Within this step there are four techniques available to the collaboration engineer toward design validation: pilot testing, walk-through, simulation or expert evaluation. The end result of the CE Design Approach is an outlined collaboration process design artifact which is transferred to the practitioner to utilize during the enactment of the collaboration task. The role of the practitioner is focused on guiding the group in executing the collaboration process based on the design devised earlier. Thus, the practitioner, with limited facilitation expertise, can use the collaboration process design to lead the group toward achieving the collaboration goals. (Kolfschoten & de Vreede, 2007)

In a study by Kolfschoten and de Vreede (2007) the CE Design Approach was evaluated by its capacity to provide guidelines to novice collaboration engineers. In this study a design booklet was created and distributed to groups of students in a face-to-face setting charged with designing collaboration processes. In essence, participants were asked to use the CE design approach to both learn the CE process itself as well as create a design process for a practitioner. The study findings indicate that the approach and supplemental material were useful, but it was difficult for students to learn and apply all of the complex elements in a limited time frame (Kolfschoten & de Vreede, 2007). An additional study by Tarmizi et al. (2007) evaluated the feasibility of CE in a different manner, through a distributed environment. An important concept in this study, which is relevant to and difficult in virtual

teams, is the development of a shared understanding through process use and team leadership. This study was one of the first studies to address this research issue. This study was also unique in that it paid specific attention to relational link development. “Although existing CE techniques primarily focus on task-related processes, these techniques can also be specifically designed to promote relational development” (Tarmizi et al., 2007, p. 81). Results of the study show that virtual teams find it challenging to take advantage of the proposed collaboration process pattern concepts and techniques to improve various levels of satisfaction within a virtual team. Tarmizi et al. (2007) offer the suggestion of using “pre-training” on virtual team membership with the end effect of possibly encouraging team members to think differently about virtually collaborating and to teach them specific things to which they need to pay attention to. The results from these two studies indicate the need for further research in the area. Kolfscholten and deVreed (2007) determined that the CE design approach offers useful and effective support, but takes a considerable amount of time to absorb and use the information and materials. This finding supports continued use of the CE design approach for novice practitioners with the caveat of providing more support through a computer based expert tool. The findings from Tarmizi et al. indicate that the CE design approach can be effective in a distributed environment as well. Both of these studies support the notion that the CE Design Approach is a useful technique which is limited in its effectiveness due to the high cognitive effort involved as it has been previously taught and tested. The research opportunity this presents is the establishment of a training program which utilizes components of the CE design approach and adjusts the methods by which it is taught to practitioners. Adjusting how the design approach itself is taught includes incorporating theories and techniques which support utilization of the technique at a higher level.

The value of collaboration activities was noted during the development and testing of GDSS systems several years ago. During the time period since this development, the field of collaboration engineering offers one approach toward providing structured facilitation to collaboration tasks which was created and guided through rigorous research methods. Collaboration Engineering looks to provide novice practitioners with a collaboration process prescription developed by professional facilitators. The difficulty with this method lies in the

inherent lack of knowledge and skills developed in the practitioner. Through this process the practitioner does not develop the collaboration skills necessary to facilitate a collaboration process which does not have a process prescription created by a collaboration engineer. Not all collaboration processes will have access to a collaboration engineer. One way to overcome this difficulty is to foster the development of these skills in the practitioner through process structure training. Within the field of collaboration engineering two methods which have been used to provide process structuring skills in collaboration engineers are thinkLets and the CE design approach. Both of these methods provide structure and support for the Collaboration Engineer. The thinkLet provides repeatable patterns of collaboration which can be reused and adjusted. The CE design approach provides a set of guidelines which has been shown to support collaboration engineers. The next step is to see if these methods can support the practitioner and determine the impact this support has on a collaboration success.

Collaboration Success Factors

Collaboration success is a difficult concept to define and measure. Collaboration success can be evaluated in different manners based on different definitions and perspectives. One must also determine whether they are going to measure the outcome or the process itself, or both. This measurement can be done objectively through careful analysis of resources such as time spent on task or through quantitative methods which measure success from a participant's perspective.

The most applicable definition of success and key variables of success for this research is by Duidenvoorde, Briggs, Kolfschoten and de Vreede (2009). They define collaboration success as "the appreciation of joint effort and its outcome by relevant stakeholders." (Duidenvoorde et al., 2007, p. 2) To determine their definition and variables they extensively focused on the outcomes of (Fjermestad & Hiltz, 2001) in their overview of the results of almost 200 GSS research studies. They further define five success dimensions for collaboration: group effectiveness, group efficiency, group productivity, commitment of resources to the group goal and participant satisfaction. The first success dimension for

collaboration is group effectiveness. Group effectiveness indicates collaboration success through determining that the group goal is achieved and that the results meet the requirements (Duivenvoorde et al., 2009).There is some inherent difficulty in determining group effectiveness based on varying expectations and perceptions of the stakeholder. The second success dimension for collaboration is group efficiency. Group efficiency focuses on the difference between the amounts of resources used compared to the amount of resource utilization planned. One of the important aspects of group efficiency is the determination of resources utilized by a stakeholder during the collaboration process. These resources can include time, suggestions, knowledge sharing and even physical resources such as money. The third success dimension for collaboration is group productivity. Productivity is important toward determining if the qualities of the results are equal to the expense of resources. In essence productivity looks to determine if there is a balance between the time and effort spent on a collaboration task and the overall quality of the end result. The fourth success dimension is commitment. Commitment focuses on the availability of resources. This availability is determined through a stakeholder's willingness to expend these resources toward the group goal. Commitment can be defined as "a force that binds an individual to a course of action of relevance to one or more targets" (Meyer & Herscovitch, 2001). Commitment can determine such indications as lack of effort and participation. The fifth success dimension is participant satisfaction. A key indicator of participant satisfaction is the perception of goal attainment within a task (Duivenvoorde et al., 2009). An individual must perceive the either the attainment of goals of the likelihood of attaining a goal in order for a positive response to manifest.

This study applies these factors to collaborative success: efficiency, effectiveness, productivity, commitment of resources and satisfaction with results and processes to evaluate the outcomes of collaboration that are examined here.

Summary

The primary focus of Chapter 2 is to explore the key bodies of knowledge within the field of virtual teams and collaboration. This exploration focuses on developing an

understanding of these fields in order to effectively employ a unique and theoretically based training program. The first body of knowledge exploration focuses specifically on virtual teams. There are several key topics which can be found in these bodies of knowledge: the difficulties inherent to virtual teams, relational links, process structuring, theory development and utilization and the Team Performance Model (TPM). Difficulties include reliance on communication technologies, geographical dispersion, limited boundaries, cultural differences and the swift-starting nature of virtual teams. Relational link development can overcome these difficulties through the development of trust amongst team members. Trust can increase confidence and security within team member relationships and encourage an environment in which information can be open and freely exchanged (Jarvenpaa et al., 1998). Process structuring can overcome difficulties inherent to virtual teams through the establishment of work processes. At this point in the literature review an exploration of the development of theories and their utilization is important toward developing a solid theoretical building block upon which the training program could be established. This inquiry shows how the Team Performance Model framework supports relational link development and process structuring. The second body of knowledge exploration further develops the process structuring components of the training program through an in-depth exploration of techniques utilized by the field of collaboration engineering. Within this body of knowledge there are specific techniques utilized for collaboration process structuring guidelines and knowledge building. These techniques include the utilization of the thinkLet and the creation of the collaboration engineering design approach. These two techniques lend expertise toward the development of process structuring skills in a training program for practitioners. The third and last body of knowledge focuses on collaboration success. This exploration shows how collaboration success can be utilized as a means for evaluating a training program based on several dimensions of success.

CHAPTER 3

Collaboration Training Program

This chapter represents the conceptual development of the collaboration training program proposed in this study. It builds upon past literature by addressing the research gaps and using the earlier theoretical developments as the foundation for the training program. The chapter begins by outlining the training program requirements. The requirements focus on the development of two key skill sets within the participants of the training program: relational link development skills and process structuring skills. The development of these skill sets are fostered through additional training program requirements such as the strong theoretical grounding of the program as well as the learner focused objectives. The next section provides a discussion of the theoretical framework for the training program. The theoretical framework first provides the basis in upon which the development of relational links and process structuring is rooted. The two key theories in this section are the Team Performance Model and the collaboration engineering design approach. The theoretical framework then focuses on grounding the objectives of the training program in an educationally based evaluative framework, Bloom's revised taxonomy of learning. The collaboration training program design further divides the requirements of the training program into a sequence of applicable techniques focused on participant development. This prescription outlines the objectives and processes fundamental to the training program.

Training Program Requirements

The requirements of the collaboration training program focus specifically on filling research gaps within the vast bodies of knowledge fundamentally rooted in virtual teams and collaboration engineering. Based on this grounding the training program should:

1. provide relational link development skills in novice practitioners

2. provide basic process structuring skills for novice practitioners
3. be flexible across modes and channels of communication
4. have a strong theoretical grounding
5. be learner focused

The first requirement of the collaboration training program is to provide participants with key concepts and ideas for enhancing relational links with team members. There are three primary factors as to why virtual teams do not develop relational links. The first factor is that there is not enough depth in media to convey emotions (Warkentin & Beranek, 1999). Media richness theory and social presence theory state that computer-mediated group interactions are "lacking in their ability to share socioemotional information and cues needed to develop trust, warmth and other interpersonal affections" (Warkentin & Beranek, 1999, p. 271). Second, ad-hoc groups do not have time to develop relational links. "Computer-supported groups, given adequate time, will exchange enough social information to develop strong relational links" (Warkentin & Beranek, 1999, p. 273). Third, team members focus on task activities and exclude relational link development (Munkvold & Zigurs, 2007). The training program includes an orientation and trust building module to establish relational link development which is not dependent on specific media but relies more on process development. This module also establishes knowledge of simple activities toward relational link development and stresses the importance of these activities toward the overall success of the collaboration activity.

The second requirement of the training program is to foster the development of collaboration process structuring skills in participants with no previous formal training. The process structure activities within a virtual collaboration can be hindered for several different reasons. First, for those individuals who are comfortable with a virtual team environment, each may realize difficulties due to the differences in experience levels of participants (Munkvold & Zigurs, 2007). Completion of the training program will put everyone on the same level as far as development of relational links and process structuring knowledge using this technique. Second, there are currently also a number of different collaboration tools available which vary in complexity (Munkvold & Zigurs, 2007). Specific tools will be used

for the training program, such as discussion boards, creating a base level of knowledge of available tools. Third, to add further complexity to the process, there is also the issue of the varying nature of group tasks that are executed by virtual teams and the lack of structure within group tasks (Munkvold & Zigurs, 2007). To overcome this complexity, the training program describes how to break down known deliverables into various group tasks. Lastly the complexity of group process and the lack of knowledge of how to structure group processes is also a common issue (Munkvold & Zigurs, 2007 ; de Vreede & Briggs, 2005). The training program provides group process structure knowledge, sample activities and sample exercises to complete.

The third requirement of the training program is to be flexible across modes and channels of communication. The purpose of this requirement is to increase opportunities to replicate the training program in diverse environments. The fourth goal of the training program is to be grounded in a strong theoretical underpinning. The theoretical underpinning of the program provides aspects of reliability and feasibility to the training program through focusing on proven and tested concepts and processes. The fifth goal of the training program is to be learner focused. The fifth goal of the training program closely corresponds with the fourth goal in that the learner focused attributes of the training program are deeply rooted in theoretical groundings found in education literature. In order to fulfill the training program requirements each aspect of the program is rooted in theory.

Training Program Theoretical Framework

The collaboration training program contains an introduction and six modules. The introduction focuses on fostering in participants a need for a support mechanism for virtual teams through the exploration of the potential benefits and roadblocks found when working in virtual teams. The introduction also provides participants with a training program guide which outlines the contents of each module and provides instructions for the completion of activities related to each module. Each subsequent module within the collaboration training program is grounded in a theoretical approach. Table 3 provides a tabular representation of the

collaboration training program framework. Appendix A: Group Training contains the collaboration training program information distributed to students.

Table 3: Collaboration Training Program Framework

	Collaboration Training	Goal	(TPM)	Goal	CE Process Design	Goal
Relational Links	*Module 1*: Orientation & Trust building	Build relational links: group introduction, formation.	Orientation	To understand why you are here.	-	-
		Build relational links, develop communication.	Trust building	To understand who you are working with.	-	-
Process Design	*Module 2*: Structuring Group Activities	Develop goals, deliverables and objectives.	Goal clarification	To understand what the team is doing.	Task diagnosis	Develop goals, deliverables and objectives
	Module 3: Activity Decomposition	Identify sub-activities with corresponding patterns of collaboration.	Goal clarification	To understand what the team is doing.	Task decomposition	Identify sub-activities with corresponding patterns of collaboration.
	Module 4: Applying Repeatable Techniques	Identify unit activities with appropriate thinkLets.	Commitment	To determine how the team will complete the task.	Task thinkLet choice	Identify unit activities with appropriate thinkLets.
	Module 5: Agenda building	Organize activities sequentially and logically.	Implementation	To determine who does what, when and where.	Agenda building	Organize activities sequentially and logically.
	Module 6: Design validation	Validate the process design	-	-	Design validation	Validation of process design

Phase I: Relational Link Development & The Team Performance Model

The first module, Module 1: *Orientation and Trust Building*, leverages the Team Performance Model. The first two stages within the TPM - orientation and trust building – are utilized because they focus solely on the development of relational links. Module 1 also includes example orientation and trust building activities such as ice breakers, group formation activities and the Rules of Netiquette. These activities encourage the establishment of communication norms and mutual regard for teammates. Communication norms include the establishment of a communication tool and process, such as each individual team members time spent online.

Phase II: Process Structuring Development & The Collaboration Engineering Design Approach

Modules 2 through 6 of the collaboration training program leverages process structuring techniques prescribed in the Collaboration Engineering (CE) process design approach and provides example application of the material. The product of each module is built upon in each subsequent module. Module 2: *Structuring Group Activities* includes an outline of the steps towards task analysis, group member analysis and resource analysis, a sample activity and instructions for completing the activity requirement for the module. Module 3: *Activity Decomposition* discusses the process for further break-down of the tasks or activities required to complete each deliverable. This analysis includes the application of the five patterns of collaboration to each task process. Module 3 also includes a sample activity and instructions for completing the activity requirement for the module. Module 4: *Applying Repeatable Techniques to Activities* uses the results of the previous module to apply repeatable techniques based on the patterns of collaboration prescribed in Module 3. Participants are given one repeatable technique to utilize for each pattern of collaboration. Module 4 also includes a sample activity and instructions for completing the activity requirement for the module. Module 5: *Agenda Building* provides a framework for organizing each of the deliverables from the previous modules into a consistent agenda template. Module 5 also includes a sample activity and instructions for completing the activity requirement for the module. Module 6: *Design Validation* provides guidelines for validation of the results of each of the previous modules.

Two adjustments were made to the CE process design approach within the design of this training program. First, the design approach has limited support for relational link development, thus the addition of the TPM model for module one. Second, the CE process design approach is an extremely in-depth approach for process structuring. In a study by Tarmizi et al. (2007), which utilized the CE design approach in a distributed environment, they found students were often overwhelmed by the process and the material. The application of a novel concept such as a thinkLet proved to acerbate this problem. To help alleviate some of these issues, participants in the collaboration training program were presented with one

thinkLet per pattern of collaboration. They were also given abbreviated versions of each thinkLet. These versions focused on the most essential component, the thinkLet rules. Rules describe the actions participants must take, the constraints under which they must act, and the capabilities they will require to execute the actions (Kolfschoten et al., 2006a; Vreede et al., 2006).

Phase III- Module Goals & Objectives- Bloom's Revised Taxonomy

The collaboration training program leverages the revised version of Bloom's Taxonomy of Learning as an instructional design tool to develop specific goals and objectives for the training program toward facilitating participant utilization of the techniques in the training program. In order for participants to utilize the training program they must first reach a high level of understanding of the concepts and techniques. Because the facilitation and training protocol is premised on participant learning and utilization, it makes sense to anchor the objectives of the approach in learning theory. Learning has been described as, "a change of state of a human being that is remembered and makes possible a corresponding change in the individual's behavior in a given type of situation." (Gagne, 1984). While socio-constructivism remains the basis for the interactions described in the collaboration facilitation of this study, a more structured framework is needed to support the objectives of participant learning.

Bloom's Taxonomy, Figure 3, is one of the most universally accepted approaches to understanding the nature of learning outcomes. Traditional uses of Bloom's Taxonomy focus on it as a benchmark for measuring a student's level of understanding of a subject. Bloom's taxonomy is a cognitive taxonomy for categorizing educational units based on their learning objectives (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). In this hierarchy there are six levels of learning; knowledge, application, analysis, synthesis and evaluation. (Howard, Carver, & Lane, 1996). Knowledge represents the lowest level of learning. Evaluation represents the highest level of learning. Upon reaching this level of learning, students have the

ability to determine a better solution within a problem domain among many solutions (Howard et al., 1996).

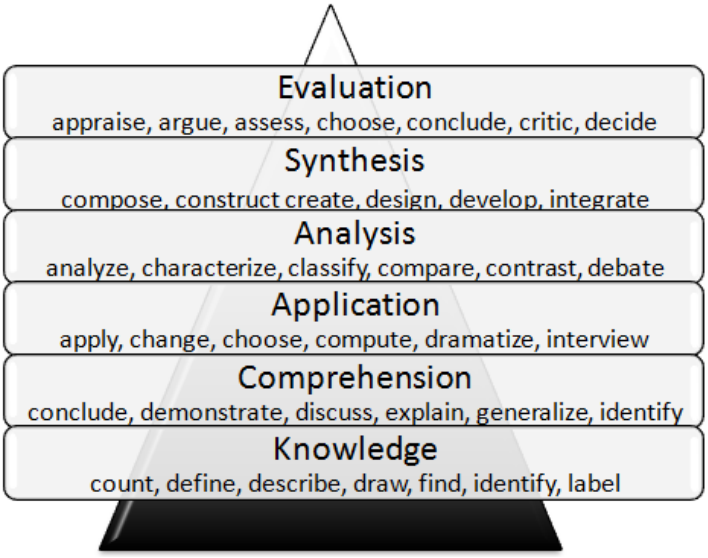

Figure 3: Bloom's Taxonomy- adapted from (Howard et al., 1996)

During the time period between 1995 and 2000 several educators worked on a revision of Bloom's taxonomy. In the revision, several important aspects of the original taxonomy were retained. There were two benefits to the revision of the taxonomy. First, many believe it increased the usefulness and usability of the taxonomy. Second, the revision takes into consideration recent developments in educational and psychological literature. These recent developments show an introduction to new learning theories and approaches which are based upon a constructivist approach (Amer, 2006). The constructivist approach has also been widely used to design and evaluated online learning programs. Constructivism sees learning as, "a proactive activity, requiring self initiated motivational and behavioral processes as well as metacognitive ones," (Zimmerman, 1998, p. 1). Constructivism also assumes that students must discover, construct, and transform knowledge if they are to adapt the knowledge as their own. The six categories in the revised taxonomy are remembering, understanding, applying, analyzing, evaluating and creating. Figure 4 represents the six categories in the revised version of Bloom's taxonomy.

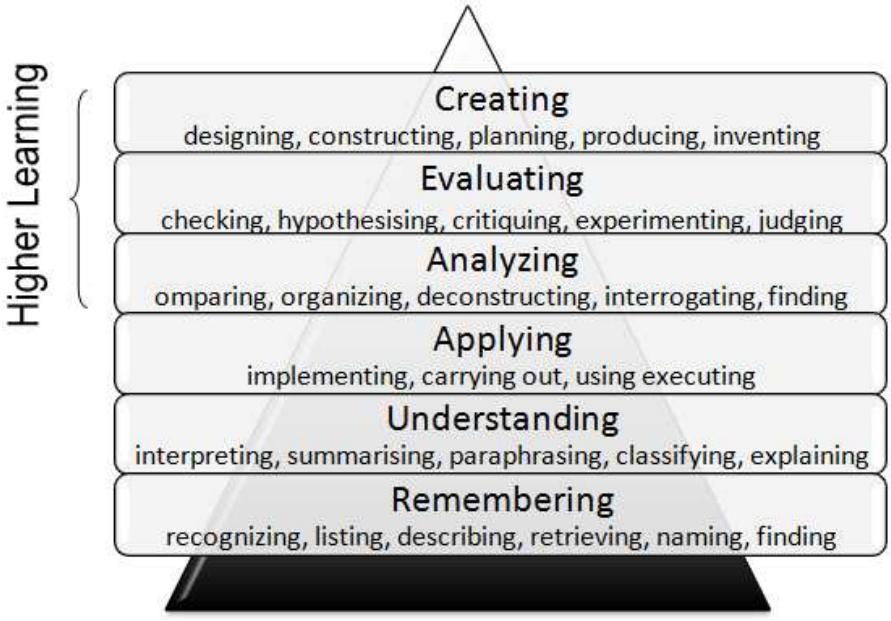

Figure 4: Bloom's Revised Taxonomy- adapted from (Krathwohl, 2002)

In this research the revised taxonomy was used as a way to structure and facilitate the goals and objectives of the training program in a hierarchal manner. The learning objectives further serve as a guide within the training program design to move students from the remembering level of mastery to the evaluating and creating level of mastery. Bloom's Taxonomy was not utilized as a basis for assessing learning outcomes of the collaboration activity itself.

Collaboration Training Program Design

The collaboration training program design components directly correlate with the five program requirements outlined previously. The first requirement focuses on the development of relational links among virtual team members, while the second requirement focuses on providing structure to collaboration work processes. The training program consists of a series of sequential training modules and has been designed for e-learning settings which correlate with these two requirements. This allows virtual team members, who are geographically dispersed, to easily participate in the training. The third requirement of the training program is

that it is flexible across modes and channels of communication. In order to facilitate this requirement emphasis was placed on the content and the techniques utilized in the training program rather than the technical mode in which it was distributed. To distribute and manage the training program in this study, Desire2Learn (D2L), a course management system (CMS) was utilized. The training program is not limited to this CMS, but does require a process for providing participants with content, including items such as OneNote files, PDF files and lecture videos, and a tool for students to complete and submit required activities. While the overall recommended time of the training program is one work day, it is possible to modularize the program into smaller segments spanning an extended period. The fourth and fifth requirements are both met through the design of the activities for each module. The fourth requirement of the training program maintains that the training program be theoretically grounded. This requirement can be seen in the design of the training program through the further utilization of Bloom's revised taxonomy. The taxonomy plays a key role in the creation, outline and organization of each of the activities within each module. The fifth requirement is that the training program have a learner focus. This requirement is also met through the utilization of Bloom's revised taxonomy in the design of the training program. Table 4 outlines the lesson objectives and goals designed for the training program framework which are rooted in Bloom's revised taxonomy toward establishing training program requirements.

Table 4: Collaboration Training Individual Module Design

Steps	**Agenda**
Training Program Justification and Instructions	
Phase 1: Developing relational links	
Module 1: Orientation and Trust Building	**Activity 1 (Bloom's level of learning: Remembering)** • Receive visual informational diagrams of the Orientation and Trust building model and associated activities and watch brief, pre-recorded informational videos on key aspects of the model. (Lecture video, OneNote & PDF file). • Complete activity to put each of the TPM stages and the questions that each stage answers in order. (Multiple Choice Question) • List 4 activities given to accomplish orientation and trust building goals. (Essay

Steps	Agenda
	Question) **Activity 2 (Understanding)** • Provide a written evaluation which discusses, in their own words, the orientation and trust building stages of the TPM. (Essay Question) **Activity 3 (Applying)** • Write an explanation explaining to others why orientation and trust building is important. (Essay Question) **Activity 4 (Analyzing and Evaluating)** • Examine each step in the Orientation and Trust Building module, order them by their level of importance and provide justification. (Matching & Essay Question) **Activity 5 (Creating)** • Develop one additional activity for accomplishing the goals of the Orientation and Trust Building Module. (Essay Question)
Phase 2: Structuring collaboration processes	
Module 2: Structuring Group Activities	**Activity 1** (Remembering) • Receive 1 page outline of task diagnosis process, watch brief lecture video explaining process steps including: task, stakeholder, resource and practitioner analysis. (Lecture video, OneNote and PDF file) • List task diagnosis process steps in order. (Matching Question) **Activity 2** (Understanding) • Write a brief explanation of each step of the Task Diagnosis process in your own words. (Essay Question) **Activity 3** (Applying, Analyzing, Evaluating and Creating) • Receive a sample group project description • Outline each stage of the Task Diagnosis process. This includes determining if any crucial information is missing. • Make suggestions on specific areas within the group project description which would improve the Task Diagnosis process deliverables or the process.
Module 3: Activity	**Activity 1** (Remembering) • Receive 1 page outline of activity/process decomposition, including the patterns of

Steps	Agenda
Decomposition	collaboration and watch a brief lecture video explaining process patterns including: generate, reduce, clarify, organize, evaluate and build consensus. (Lecture video, OneNote and PDF file) • Complete activity which will ask them to match the patterns of collaboration with their definition. (Matching Question) **Activity 2** (Understanding) • Summarize the patterns of collaboration in your own words. (Essay Question) **Activity 3** (Applying and analyzing) • Further break down the list of deliverables from the sample exercise into the various patterns of collaboration. (Matching Question) **Activity 4** (Evaluating and creating) • Evaluate the patterns of collaboration and offer suggestions for improvement or additions. For example, is there a pattern which is missing? Should the definition of a pattern be simplified? (Essay Question)
Module 4: Applying Repeatable Techniques to Activities.	**Activity 1** (Remembering) • Receive multiple page outline of applying repeatable techniques to activities. (Lecture video, OneNote and PDF file) • Complete activity which will ask them to match thinkLets with the correct pattern of collaboration. (Matching Question) **Activity 2** (Understanding) • Out of the list of 10 repeatable techniques, pick 2 techniques and explain the main goals of each one in their own words. (Essay Question) **Activity 3** (Applying) • Explain the process of utilizing repeatable techniques in their own words. (Essay Question) **Activity 4** (Analyzing, evaluating and creating) • Examine all of the given repeatable techniques. Rank them in order from the most useable (1) to the least useable (10). (Ranking Question) • Receive sample activity, decide with technique you would pick for each activity and creating outline of process. (Essay Question)

Steps	Agenda
Module 5: Agenda Building	**Activity** 1 (Remembering) • Receive agenda template and sample activities and watch a brief lecture video explaining the steps taken to create an agenda. (Lecture video, OneNote and PDF file) **Activity 2** (Understanding) • Describe in your own words the importance of creating an agenda. (Essay Question) **Activity 3** (Applying) • Create a sample agenda based on the activities from sample exercise. (Essay Question) **Activity 4** (Analyzing and evaluating) • Analyze the agenda building template. Offer suggestions for improvement. (Essay Question) **Activity 5** (Synthesis) • Construct a sample agenda. (Essay Question) **Activity 6** (Creating) • Offer additional agenda building activities. (Essay Question)
Module 6: Design Validation	**Activity 1** (Remembering) • Receive design validation tools and watch a brief lecture video. (Lecture video, OneNote and PDF file) **Activity 2** (Understanding) • Explain design validation tools in their own words. (Essay Question) **Activity 3** (Applying, analyzing, evaluating and creating) • Develop a list of criteria to evaluate an agenda (Essay Question)

Summary

This chapter summarizes the conceptual development of the collaboration training program proposed in this study. The collaboration training program was developed through a

rigorous process of defining the program goals and establishing the structure and theoretical basis of the structure. The first step in this process was to determine and outline the precise training program requirements. There are five requirements of this training program: (1) provide relational link development skills in novice practitioners, (2) provide basic process structuring skills for novice practitioners, (3) be flexible across modes and channels of communication, (4) have a strong theoretical grounding and (5) be learner focused. The second step in this process was to use these requirements as a guideline toward developing the theoretical framework of the program. There are three key theoretical underpinnings found in this training program: the team performance model, the collaboration engineering design approach and bloom's revised taxonomy. The third step toward developing the training program was to design and build the training program. This step built upon the contributions of steps one and two as each aspect of the design of the program relates to the requirements of the program as well as the theoretical framework of the program. The end result of this chapter is a collaboration training artifact which focuses on the development of key collaboration skills in practitioners. An extended research campaign with a pilot study and extended study then took place to further evaluate the application, feasibility and results of administering the training program.

CHAPTER 4

Pilot Study Research Design

Chapter 4 describes the first phase of an extended evaluative effort to focus on the impact of the collaboration training program outlined in the Chapters 1, 2 and 3 on collaborative success. The first phase of this evaluative effort was a pilot study, completed in the fall of 2009. The pilot study focused on evaluating the training program feasibility and the relationship between collaboration training and work processes. The first section of this chapter focuses on the theoretical model established in the training program. The pilot study theoretical model focuses on the relationship between the collaboration training program and work processes. Relational link development and process structuring fall under the umbrella of work process in this study. The second section of this chapter focuses on the hypothesis established for this research. The third section of this chapter outlines the design of the research study utilized for the pilot study.

Theoretical Model

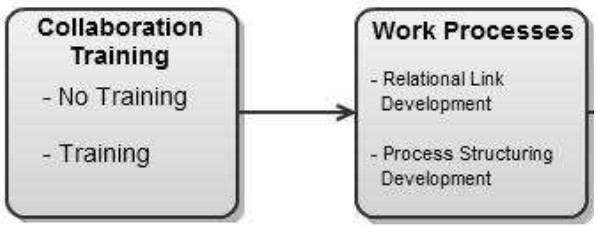

Figure 5: Pilot study theoretical model

The theoretical model for the pilot study, Figure 5, focuses primarily on the relationship between two constructs: collaboration training and work processes. Work processes include relational link development and process structuring. Work processes include these two variables as they are the cornerstone of this research. The research

objectives for the pilot study were to establishing two key criteria. First, does the collaboration training program increase instances of collaboration process structuring and relational link development? Second, is the collaboration training program feasible at an acceptable level? Feasibility includes usefulness, completeness, training quality and mental effort of the collaboration training program (Kolfschoten et al., 2006).

The establishment of these two key criteria was necessary as they specifically relate to the first three training program requirements. The first requirement is the establishment of relational link development skills in novice practitioners. The second requirement is the establishment of process structuring skills in novice practitioners. Testing the feasibility of the training program closely relates to the third requirement of the training program in that it is flexible across modes and channels of communication. This requirement can relate to the technology or to the techniques utilized in the training program to communicate the various aspects of the training program.

Hypothesis

Upon completion of the pilot study theoretical model, two hypotheses were developed which center on the key relationships posed within the model. The first hypothesis, H1, focuses on the impact the collaboration training program will have on instances of relational link development noted by members. This hypothesis poses that members receiving the collaboration training program will note increased instances of relational link development. The second hypothesis, H2, focuses on the impact the collaboration training program will have on the instances process structuring development noted by members. Our hypothesis poses the members receiving the collaboration training program will note increased instances of process structuring.

- *H1: Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.*

- *H2: Members receiving the collaboration training program will note increased instances of process structuring development in a collaboration group activity.*

Research Design

The pilot study for the collaboration training occurred in the fall of 2009. The course in which the training program was evaluated utilized online delivery methods only and thus was considered a virtually distributed course. In order to control any factors which may influence the outcome of the study, two projects for the course were developed, project 1 and project 2. There were also two phases to the experiment which coincided with the development of the two projects in the course. Each project had a similar deliverable but focused on a different content area. Care was taken to make sure that the requirements for the projects were indeed collaboration and not cooperative in nature.

The study utilized laboratory experimentation research strategy using surveys for data collection. The surveys were administered as online anonymous survey through a Course Management System readily available to students. The first survey utilized was the Virtual Team Survey, see Appendix B. The Virtual Team Survey is a survey questionnaire adapted from Lurey and Raisinghani (2001) and composed of specifically created relational link development questions. The survey also included several questions on process structuring in groups. The Training Feasibility Test survey, see Appendix C, is a survey questionnaire adapted from Kolfschoten et al (2006) which was administered to test the feasibility of the training program. The survey focuses on the evaluation of the usefulness, completeness, training quality and mental effort of the collaboration training program.

For phase I, project 1, students were randomly assigned to four groups of 4 and one group of 3. Students were given instructions to utilize collaboration processes to complete the project; i.e. they were directly instructed to utilize collaboration processes rather than cooperative processes. Prior to project 1 students were provided with the project requirements and deliverables. Students were required to complete the project using any collaboration skills they inherently have. Each group was required to keep track of and report all group related

activity. This included meeting agendas and all communication such as emails, chats, and online discussions. Upon the completion of project 1, the Virtual Team Survey was administered to each individual in the class.

The second phase, phase II, began with students individually completing each module of the collaboration training program. The program was given for credit only. Upon completion of the collaboration training program, the Group Training survey was administered to test the feasibility of program. Students were then randomized into groups and assigned the task of collaboratively completing project 2. Each group was required to keep track of and report all group related activity. Upon completion of the project, the Virtual Team Survey was administered to each individual in the class. See Figure 6 for an overview of each phase of the experiment.

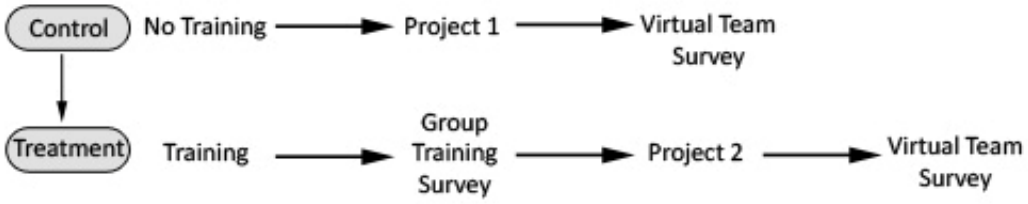

Figure 6: Collaboration Training Experimental Design

The experimental tasks for the pilot study were two separate, but similar, projects. Project 1 consisted of students collaboratively creating a marketing design plan and marketing piece for a museum exhibit. Within the project there were four different roles utilized by students: public relations manager, graphic designer, project manager and content manager. Students were responsible for determining these roles. Project 2 consisted of creating a marketing design plan and marketing piece for a museum exhibit based on a different period in graphic design history. At the conclusion of the pilot study the data collected by the surveys was statistically evaluated.

Summary

Chapter 4 establishes the first phase of an evaluative extended effort, the pilot study. This chapter first looks to establish the pilot study theoretical framework. There were two key criteria for the establishment of the pilot study theoretical framework. The first criterion was the exploration of the relationship between the collaboration training program and instances of relational link development and process structuring, labeled work processes, in a collaboration activity. The second key criterion was the evaluation of the feasibility of the training program. The chapter then establishes the hypothesis for the pilot study based on the theoretical framework. The first hypothesis, H1, posits that members receiving collaboration training will note increased instances of relational group development in a collaboration activity. The second hypothesis, H2, posits that members receiving collaboration training will note increased instances of process structuring development in a collaboration activity. The last section of the chapter outlines the details of the pilot study. These details include the design of the phases and projects utilized within the pilot study. The next chapter reports the results of the pilot study.

CHAPTER 5

Pilot Study Results and Discussion

This chapter presents the results of first phase of an evaluative extended campaign, the pilot study. It builds upon the previous chapter by analyzing the outcome of the pilot study outline in Chapter 4. The first step in this process is to evaluate the results of the pilot study. Chapter 4 established two key criteria or research objectives for the pilot study. The first objective, which correlates with the hypotheses, evaluates the relationship between the collaboration training program and instances of relational link development and process structuring. This analysis includes a one-way analysis of variance (ANOVA) test to evaluate the means of the populations for correlations and factor analysis to determine if underlying factors were responsible for correlations in the data. The second objective looks to determine the feasibility of the training program. Feasibility includes usefulness, completeness, training quality and mental effort of the collaboration training program (Kolfschoten et al., 2006). The chapter concludes with an in-depth breakdown of the results of this analysis as well as a brief discussion of the limitations found within the pilot study.

Results

The first research objective for the pilot study focused on discovering if the collaboration training program increased instances of relational link development and collaboration process structuring. The statistical analysis included two key tests. First, a one-way analysis of variance (ANOVA) test was used to test the means of several populations. Second, factor analysis was used to determine if underlying factors were responsible for the correlations in the data.

ANOVA Results

The one-way ANOVA test was run on the results of the Virtual Team Survey given in the pilot study. Tukey's family error rate was set to 5. A significance level of .05 was used for all statistical analyses. To determine if there was a statistical significance among means, each p-value was evaluated for significance, confidence level and whether Tukey's test contained a zero. Within the survey there were a total of 28 questions, split into two different sections. The first 19 questions focused on relational link development and the last 8 questions focused on process structuring development. In the first 19 questions, the p-value was considered significant in 8 out of the 19 questions. In those 8 questions, 4 questions exhibited a significant p-value, a non-overlapping 95% confidence level and Tukey's test did not contain a 0. See Table 5.

Table 5: ANOVA results for relational link development.

	p-value	Significant	95% Conf. Int	Tukey's
Rel-3: Time was dedicated to team building exercises	0.000	Y	No overlap	No zero
Rel-6: Team members experienced a sense of shared goals and objectives	.004	Y	No overlap	No zero
Rel-7: Our team was a cohesive unit	0.007	Y	No overlap	No zero
Rel-18: There was respect for individuals on the team	0.007	Y	No overlap	zero

In the last 8 questions, which focused on process structuring, the p-value was considered significant in 2 out of the 8 questions. These two questions also exhibited a significant p-value, a non-overlapping 95% confidence level and Tukey's test did not contain a 0. See Table 6.

Table 6: ANOVA results for process structuring questions.

	p-value	Significant	95% Conf. Int	Tukey's
ProcStruc-23 – Team members had a shared understanding of the teams goals and requirements	0.004	Y	No overlap	No zero
ProcStruc-24 – In the initial phase of the project, the team collaboratively decided on the activities needed to complete the requirements	0.012	Y	No overlap	No zero

The results of the ANOVA statistical analysis demonstrate evidence of statistical significance between the population means in the pilot study, thus supporting (H1): *Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training* and (H2): *Members receiving the collaboration training program will note increased instances of process structuring development in a collaboration group activity.* If there were no significances indicated from the test, the result could be a null hypothesis.

Factor Analysis

The next step in the statistical analysis of the pilot study was to run a factor analysis on the survey results to determine if the results would show that there were indeed two factors. The guidelines provided by Hair et al. (2008) were used in performing this analysis. Factor analysis was initially performed using a Varimax rotation. The results of this first analysis indicated that all of the questions in the survey instrument were loading on the same factor, instead of two factors. Questions 1 – 19 should have all loaded on Factor 1 (relational link development) and questions 20 – 28 should have loaded on Factor 2 (process structuring). Also, Factor 1 explained 83% of the variance between questions and Factor 2 explained less than 1% of the variance between questions. It was noted that the Varimax rotation assumes that there is no correlation between the factors, and is not the appropriate assumption for this study.

Considering that in this study there may be some overlap between the two factors, relational link development and process structuring, factor analysis was again performed with an oblique rotation of factors. . The results of the factor analysis using oblique factor rotation indicated that the overall measure of sampling adequacy (MSA) exceeded .50 for both the overall test and each individual variable, as required. However, Questions 2, 3, 7, 12, 14, 15, 21, 25, 26 and 28 were removed from the analysis, given that they were all cross-loading on both factors. The results also indicated that Questions 13, 18 & 19 did not significantly contribute theoretically or statistically so they were removed from further consideration. A total of 15 questions remained. From the final factor analysis run results using oblique rotation (as shown in Figure 7), it was observed that Questions 24, 23, 22, 27, 11, 6, 20 loaded on Factor 1, while Questions 4, 9, 1, 10, 5, 17, 8, 16 loaded on Factor 2.

Rotated Factor Pattern			
		Factor1	Factor2
Q24	Q24	0.88344	0.28154
Q23	Q23	0.86770	0.42757
Q22	Q22	0.84477	0.40835
Q27	Q27	0.79489	0.45701
Q11	Q11	0.76949	0.52993
Q6	Q6	0.75339	0.50053
Q20	Q20	0.74912	0.51449
Q4	Q4	0.20726	0.89995
Q9	Q9	0.47902	0.83496
Q1	Q1	0.48680	0.80540
Q5	Q5	0.52307	0.74597
Q17	Q17	0.58359	0.74387
Q10	Q10	0.50068	0.73943
Q16	Q16	0.59682	0.73154
Q8	Q8	0.55838	0.72803

Figure 7: Factor Analysis results

Training Program Feasibility

The second research question was to determine if the collaboration training program feasibility was at an acceptable level. Feasibility included usefulness, completeness, training quality and mental effort of the collaboration training program (Kolfschoten et al., 2006). To measure the constructs a survey was given to all training program participants. The first section of the survey utilized a 5 point scale, 1= not at all useful, 2= somewhat useful, 3= neutral, 4= useful, 5 is very useful. This section evaluated the usefulness of the training program steps. The results are in Table 7.

Table 7: Training program steps usefulness

Aspect - Usefulness	Usefulness	stdev
Usefulness of patterns of collaboration	3.61	0.70
Usefulness of exercises	3.44	0.70
Usefulness of repeatable techniques	3.33	0.69
Usefulness of general do's and don'ts and guidelines	3.72	0.75
Lecture videos	2.50	0.99
OneNote and PDF files	3.89	1.28
Sample activities and exercises	3.22	1.06
I will use the group training techniques.	3.56	1.34
The group training techniques are useful to me.	3.61	1.24
After the training, I felt better equipped to work in a group and accomplish a group task.	3.39	0.85

The usefulness of the training program itself and its application was then evaluated. This section of the survey utilized a 5 point scale, 1= very much disagree, 2= disagree, 3= neutral, 4= agree, 5 is very much agree. The results are in Table 8.

Table 8: Training program usefulness

Aspect - Usefulness	Usefulness	stdev
I will use the group training techniques.	3.56	1.34
The group training techniques are useful to me.	3.61	1.24
After the training, I felt better equipped to work in a group and accomplish a group task.	3.89	0.85

To evaluate the completeness of the program the survey asked if the training materials were complete and also provided a text box for individuals to have the opportunity to discuss materials which they felt were unnecessary. Additional comments were not added by participants about unnecessary material. The results are in Table 9.

Table 9: Training program completeness

Aspect - Completeness	Percentage "yes"
Were the group training materials complete?	83%

The training quality of different elements within the training program were also measured (see Table 10).

Table 10: Training program quality

Aspect – Training Quality	Quality	stdev
The training materials were well introduced and explained.	3.33	1.14
The training material was presented in a logical order.	3.83	0.62

The last construct evaluated was mental effort. See Table 11 for the results.

Table 11: Training program mental effort

Aspect – Mental Effort	Mental Effort	stdev
I found that the training required a lot of mental effort.	3.61	1.24
I found the training difficult.	3.17	1.04
I found the training tiring.	3.50	1.15

Discussion

The purpose of the pilot study was two-fold. The first research objective was to determine the impact of the collaboration training program on the development of process structuring and relational links in a virtual team. Past research in virtual teams indicates that a formal process to perform work, develop clear goals and objectives, and facilitate better communication among team members needs to be established to ensure efficient and effective performance of virtual teams (Lurey & Raisinghani, 2001). This study hypothesized that the proposed training program would cause an increase in the instances of process structuring and relational link development. The ANOVA comparisons demonstrated significance and

supported the research hypothesis. These findings suggest that the proposed training program increases instances of process structuring and relational link development in virtual teams.

The second research objective was to evaluate the feasibility of the training program. Feasibility included usefulness, completeness, training quality and mental effort of the collaboration training program. Feasibility needs to be at a certain level in order to make sure that the participants can successfully complete the program and to assure that the training program can be administered in different settings by different individuals as needed. The first construct evaluated was usefulness. Overall the majority of participants felt that each step within the training program was useful. The one item within this category which was not deemed useful was the lecture videos. These videos were a duplication of the OneNote and PDF material to account for different learning styles. It would be possible to make them an optional part of the training program. Participants also felt that they will use these techniques and felt better equipped to work in a group.

Training quality had somewhat mixed results. Participants felt the material was not well explained, but that the material was presented in a logical manner. The training program itself did not include an introductory module; this was implied as part of the responsibility of the individual administering the program. An introductory module could easily be included to describe the goals of the training program and include directions. The last construct, mental effort, also showed mixed results. Participants reported that they did feel the training program required a lot of mental effort and that it was tiring, but they did not all agree on the idea that it was difficult. In this instance students were given a week to complete the training program, along with additional required work for the course. If participants were not required to submit additional deliverables other than the group training deliverables, this may positively impact the results. Overall the participants responded either neutral or positive answers to the majority of the questions relating to the feasibility of the training program.

Pilot Study Limitations

There are limitations to the results found in this study. The results of the factor analysis indicated that some changes need to be made in order to improve the Virtual Team Survey. This instrumentation focused solely on process structure and relational link development. In order to improve the results, each question in the survey instrument needed to be evaluated. The results of the factor analysis indicated that the questions were not clearly loading on two factors, when they should be. Thus the questions on the survey which specifically pertain to these factors need to be evaluated, reworked and eliminated as necessary. The survey instrument in the pilot study had 19 relational link questions and 8 process structuring questions. Factors not under the control of the researchers in this study include the inability for all subjects to complete all the appropriate components of the training program. Subjects who did not complete all required aspects of the training program were not included in the study in two ways. First, their incomplete submissions were eliminated. Second, when putting together the groups for collaboration activities, care was taken to make sure those subjects who had completed the required training were put together in groups.

Summary

Chapter 5 focuses on the exploration of the results of the first phase of an evaluative extended campaign, the pilot study. This exploration includes a close evaluation of the key research objectives proposed in Chapter 4. The first key objective was to determine the relationship between the collaboration training program and work processes, which include relational link development and process structuring. This study hypothesized that upon receiving the collaboration training program, members of a collaboration activity would report increased instances of relational link development and process structuring. The results of the study were tested through the utilization of one-way analysis of variance (ANOVA) and factor analysis. These results support the rejection of a null hypothesis. The second key objective was to determine the feasibility of the training program. Feasibility includes usefulness, completeness, training quality and mental effort of the collaboration training program (Kolfschoten et al., 2006). The overall results indicate that participants felt the

training program feasibility was at an acceptable level. The importance of this chapter lies within the aspect that it is the first phase of an evaluative study of the overall impact of the collaboration training program. The second phase of the evaluative campaign, the extended study, builds upon the results of the first phase.

CHAPTER 6

Extended Study Research Design

This chapter presents the development of the second phase of an evaluative extended campaign, the extended study. The development of this phase builds upon the previous results of the first phase of the extended evaluative campaign, the pilot study. The primary focus of this chapter is the establishment of the extended study theoretical model, each correlating hypotheses and the extended study research design. The extended study theoretical model includes the constructs of collaboration training, collaboration work processes and collaboration success. Of importance to this chapter are the individual hypotheses developed according to the relationships between each construct within the theoretical model. The chapter outlines the following relationships between constructs: collaboration training to collaboration success, collaboration training to collaboration work processes, collaboration work processes to collaboration success, and mediation effects of collaboration work processes. The extended study research design outlines the specific processes and details of the extended study.

Theoretical Model

The results of the Pilot Study indicated several key outcomes. The first key outcome was increased instances of relational link group development observed in the experimental condition that involved participants taking the collaboration training program. Second, increased instances process structuring development were also observed in the experimental condition that involved participants taking the collaboration training program. Third, the results of the Training Feasibility Test Survey indicate that the training program is indeed feasible based on its usefulness, completeness, training quality and mental effort. An extended study was conducted to further explore the causal relationships between Collaboration Training, Collaboration Work Processes and Outcomes. There were three research objectives

for the extended study. The first research objective is to understand the impact of the collaboration training program on process structuring and relational link development. The second research objective is to understand the impact of process structuring and relational link development on the outcomes of a collaboration task. The third objective is to understand the mediation effect of collaboration work processes. Figure 8 depicts the combined theoretical model including both the pilot study and the extended study.

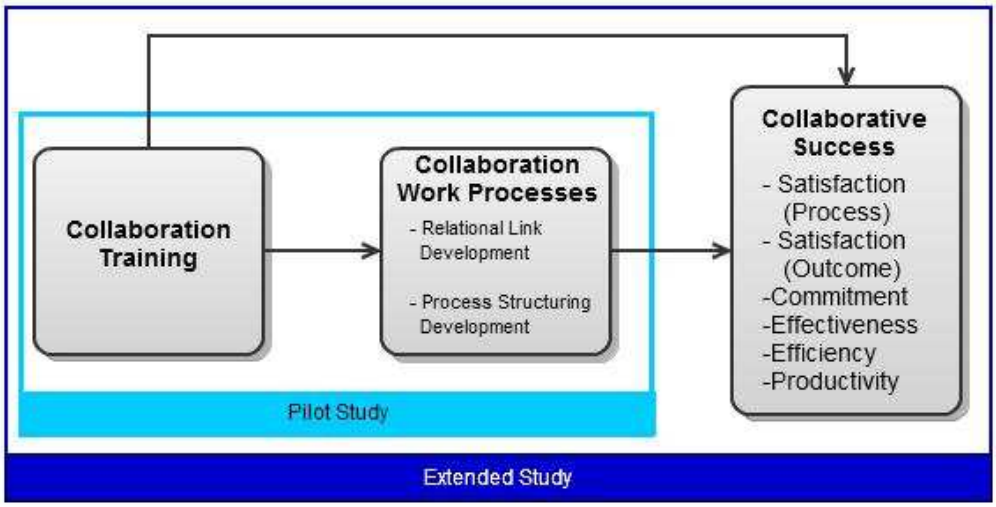

Figure 8: Theoretical Models

Collaboration Training to Collaboration Success

Previous research indicates that teams' processes and team members' relations presented the strongest relationships to effective team performance and team satisfaction (Lurey & Raisinghani, 2001). Several studies (Beranek & Martz, 2005; Furst et al., 1999; Iacono & Weisband, 1997; Jarvenpaa & Leidner, 1999; Powell et al., 2004) discuss the benefits, difficulties, and effect of lack of trust in virtual teams. These studies cite the importance of trust toward the effectiveness of virtual teams. Individuals also need to employ formally structured processes to ensure efficient and effective performance of virtual teams (Lurey & Raisinghani, 2001). This study hypothesized that team members will acquire these skills

through the collaboration training program, with the direct result being increased perceptions of collaboration success within a collaboration task.

- *H1: Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training..*

Collaboration Training to Collaboration Work Processes

Significant challenges are faced by virtual teams as a direct result of specific characteristics of virtual teams such as reliance on communication technologies, geographical dispersion, and lack of time and space organizational boundaries (Piccoli, Powell, & Ives, 2004). Through an investigation into several studies, two key concepts were consistently identified in overcoming these difficulties: the development of relational links and the structuring of team processes. The first concept is relational link development. Relational link development fosters and maintains the occurrence of trust in virtual teams. Relational links can be developed through such steps as defining member roles and establishing consistent patterns of communication (Warkentin & Beranek, 1999). The development of relational links is a challenge because ad-hoc and swift-starting groups do not have time to develop relational relationships. Team members will also often focus on task activities and exclude relational link development (Munkvold & Zigurs, 2007). Past research indicates that if virtual teams are given collaboration training, they will develop relational links stronger than teams which do not receive training (Warkentin & Beranek, 1999). The second concept is the structuring of team processes. Team processes, also deemed work processes, are the structural elements utilized within virtual teams to complete tasks. Work processes can include process development and task structure (Munkvold & Zigurs, 2007). The skills necessary to properly structure a collaboration activity are not inherent to most individuals. This skill is crucial because many collaboration activities can prove to be successful when structured properly. When an individual receives training on the use of repeatable techniques geared toward

structuring work processes, they then can then refer to these techniques in future collaboration activities.

Hypothesis:

- *H2a: Improved relational link development will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.*
- *H2b: Improved process structuring development will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.*

Collaboration Work Processes to Collaboration Success

The work process construct evaluates the processes which occur during a collaboration task, not the outcome generated by the task. Work processes can also indicate the enhancement of individual group member ability. Work processes are divided into two variables: relational link development and process structuring development. Virtual teams that exhibit high trusting behaviors experience significant social communication as well as predictable communication patterns, substantial feedback, positive leadership, enthusiasm, and the ability to cope with technical uncertainty (Jarvenpaa & Leidner, 1999). The inability for virtual teams to freely exchange information can and more than likely will negatively impact team performance. Virtual teams also require more structure in order to perform their work due to the difficult nature of virtual teams (Lurey & Raisinghani, 2001). Previous studies have shown a direct correlation between individual team member satisfaction and team effectiveness (Lurey & Raisinghani, 2001).

Collaboration success was measured from the individual participant perspective. Success was defined as, “the appreciation of joint effort and its outcome by relevant stakeholders,” (Duivenvoorde et al., 2009, p. 2) A study completed in 2009 by Duivenvoorde

et al. evaluated a number of the different variables which had previously been used to evaluate collaboration success. The result of this study was a survey instrument to specifically measure successfulness of collaboration effort from a participant perspective. The four success dimensions for collaboration are: group effectiveness, group efficiency, group productivity and commitment of resources to the group goal (Piccoli et al., 2004). Group effectiveness measures the reaching of group goals, mutual learning and the development of respect and trust in a group. Group efficiency measures the efficiency of the process. Group productivity is the balance between the result and the resources spent. Commitment of resources to the group goal is the willingness of participants to spend time, effort, knowledge and physical resources to the group goal.

Hypothesis:

- *H3a: Collaboration success increases as relational link development increases.*
- *H3b: Collaboration success increases as process structuring development increases.*

Mediation Effects of Collaboration Work Processes

This study hypothesizes that collaboration training increases collaboration success because it increases perceived instances of relational link development and process structuring within individual team members. This research contends that the positive effect that increased instances of relational link development and process structuring has on collaboration success (process satisfaction, outcome satisfaction, commitment, effectiveness, efficiency and productivity) is due to the collaboration training program effect on work processes. This research argues that relational link development and process structure development mediate the relationship between the collaboration training program and team effectiveness.

- *H4: When the effects of relational link development and process structuring effectiveness are controlled for, there is no difference between the level of collaboration success reported by members receiving the collaboration training*

program judged against their most recent group project experience prior to receiving training.

Extended Study Design

The extended study employed quasi-experimental research strategy using survey and interviews techniques for data collection. The experiment occurred in the spring and summer of 2010. In many ways the extended study was organized, administered and evaluated in a similar manner to the pilot study. There were three key adjustments made to the extended study design based on the results of the pilot study.

The experiment began with the evaluation of the process structuring and relational link development sections of the pre and post-test survey instrument. The results of the factor analysis in the pilot study indicated that the questions were not clearly loading on two factors, when they should be. Thus the questions on the survey which specifically pertain to these factors were evaluated, reworked, and eliminated as necessary. Once the questions were finalized the questions were distributed to a group of 46 students. The students were asked to put each of the questions into two separate categories. The categories were labeled, "developing relationships with team members" and "structuring tasks." The results of this activity indicated that of the questions included, students were able to correctly categorize 12 of the 14 questions on average 85.51 % of the time. There were two questions in which the students identified incorrectly 55% and 65 % of the time. These two questions were eliminated. The number of relational link questions was set at 7. The number of process structuring questions was set at 5. The survey was also adjusted to include demographic information on each student. Demographic information included gender, year in college, online course experience and group project experience. See Appendix D: Revised Team Survey Instrument. Second, minor adjustments were also made to the training program itself. The results of the feasibility survey in the pilot study indicated that the participants did not feel the lecture videos were useful. For the extended study they were made an optional component. On the average, students reported that completion time of the training program

from start to finish was three to four hours. Participants also felt the material was not introduced properly enough. An introductory section and lecture video were added to the training modules. The last adjustment made was based on the indication that participants felt the training required a lot of mental effort. To help elevate this stress, it was recommended that students were not required to complete any additional coursework during the time the training program was administered. Third, in order to increase the sample size from the pilot study, the experiment was administered in five separate courses. There were three different faculty members involved with the experiment. The same person administered the collaboration training program in all instances. The introductory module was also another component toward standardizing the implementation of the training program. The design for the extended study was adjusted due to the inclusion of multiple courses (Figure 9).

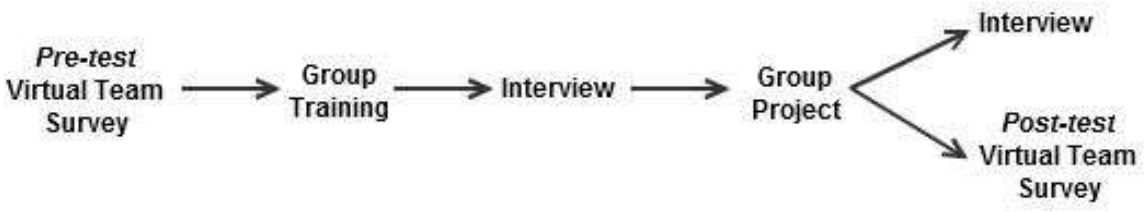

Figure 9: Extended Experiment Design

Each of the faculty members gave students credit for full completion of the training program. The amount of credit/points allotted by each faculty was at their own discretion.

The experiment continued with students in a Web Programming II class completing the pre-test survey in the spring of 2010 semester. The focus of the survey was to evaluate students' previous experience in virtual collaboration group activities as well as take into consideration both the development of relational links and process structuring and the impact of these developments on collaboration success. Completion of each module within the collaboration training program was the next step. To complete a module the students were given several different tasks within a survey format. The pre-test survey and each of the modules were set up as conditional activities, requiring students to complete the activities in a sequential manner. Upon completion of the collaboration training program, students were

randomly assigned to groups of 3 and given a collaboration task based on the criterion provided by the instructor. Students then completed the post-test survey. At this time individual students were randomly chosen for an interview session. The interview questions were divided into two groups. The first individual interview sessions were used to established qualitative information about the training program. See Appendix E for the list of interview questions. The second interview sessions were used to establish qualitative data to evaluate various indicators such as collaboration success and training program utilization. See Appendix F for the list of interview questions. This same process was then extended to the summer 2010 session to two sections of General Psychology, one section of Theory Development and Use in Design Research, and one section of Introduction to Web Design.

Summary

Chapter 6 establishes the development and organization of the second phase of an evaluative study. Within this chapter the key contributions include the development and discussion of the theoretical model and corresponding hypothesis and the research design of the extended study. The theoretical model has three constructs: collaboration training, collaboration work processes (relational link development and process structuring development), and collaboration success (process satisfaction, outcome satisfaction, commitment, effectiveness, efficiency and productivity). Each of these constructs has specific relationships with each other which are the focus of the hypotheses. The first relationship is among collaboration training and collaboration success. The hypothesis posits that the relationship between the two constructs is significant in that members receiving collaboration training will perceive greater collaboration success. The second relationship is among collaboration training and collaboration work processes. The hypotheses posit that the relationship between the two constructs is significant in that collaboration training increases perceived instances of relational link development and process structuring. The third relationship is among collaboration work processes and collaboration success. The hypothesis posits that the relationship between the two constructs is significant in that a perceived increase in relational link development and process structuring increases collaboration

success. The fourth relationship looks at the mediation effects of collaboration work processes. The hypothesis posits that relational link development and process structure development mediate the relationship between collaboration training and collaboration success. The second contribution of the chapter is the extended study details. The extended study utilized laboratory experimental research design strategy using surveys and interviews for data collection. The extended study began with a pre-test survey instrument to evaluate participant's previous experience within a collaboration activity. The participants then completed the collaboration training program. Following the training program participants were interviewed on various aspects of the training program. Participants then participated in a collaboration group activity. At the conclusion of the activity participants completed the post-test survey and also individual interviews. The data collected from this experiment is analyzed in Chapter 7.

CHAPTER 7

Extended Study Results and Discussion

This chapter presents the results and discussion from the second phase of the extended evaluative campaign, the extended study. This discussion begins with a brief introduction to the data analysis method partial least squares (PLS). This method was utilized to analyze the survey results. The chapter then provides a brief overview of the survey respondents. Upon conclusion of this overview, the first structural module, Structural Model 1, is outlined and analyzed. This analysis begins with evaluating instrument validity through examining content validity, construct validity, reliability and internal validity. Structural Model 1 is then evaluated using statistical conclusion validity to evaluate each of the proposed hypotheses. Then the second structural module, Structural Model 2, is outlined and analyzed. This analysis begins with evaluating instrument validity through examining content validity, construct validity, reliability and internal validity. Structural Model 2 is then evaluated using statistical conclusion validity to evaluate each of the proposed hypotheses. The chapter concludes with a brief discussion and lessons learned analysis.

Data Method

Partial least squares (PLS), a components-based structural modeling technique, is similar to regression, but models both the structural path and measurement paths. PLS was chosen as the data method for this research study due to the minimal demands on measure scales, sample size, and residual distributions. This method also assumes that all measured variance is useful variance which should be explained. PLS can be used for theory confirmation as well as relationship exploration (Chin, Marcolin, & Newsted, 1996). PLS utilizes an iterative estimation technique (Wold, 1982) to create a model which includes canonical correlation, redundancy analysis, multiple regression, multivariate analysis of

variance and principle components (Chin et al., 1996). The bootstrapping resampling technique was also applied to estimate standard errors.

Data Overview

A total of 58 students in 5 different online courses participated in the training program and survey. The largest class in the study, C3, had 20 participants. There were 14 females and 6 males in C3. The next largest class was C1 with 17 participants. In C1 there were 8 females and 9 males. Class C5 had 9 total respondents. All 9 respondents in C5 were males. The two smallest classes were C2 & C4 with a total of 6 participants. Class C2 had 4 females and 2 males. Class C4 consisted of 3 females and 3 males. Table 12 shows the number of respondents based on their gender.

Table 12: Respondents based on gender

Class	Male	% of class	Female	% of class	TOTAL
C1	9	52.9%	8	47.1%	17
C2	2	33.3%	4	66.7%	6
C3	6	30%	14	70.0%	20
C4	3	50%	3	50.0%	6
C5	9	100%	0	0.0%	9
TOTAL	29	50%	29	50%	58

Participants can also be broken down by their year in school. Table 11 shows the number of respondents based on their year in school. The largest number of participants was seniors at 18 or 31% of the total % of respondents. The next largest group was juniors at 12 or 20.7%. The next largest group was the sophomores at 11 participants or 19%. There were 9 graduate students who accounted for 15.5% of respondents. The smallest group of respondents was freshman with 8 or 13.8%. Table 13 shows the respondents by year in school.

Table 13: Respondents by year in school

Class	Fresh.	%	Soph.	%	Juniors	%	Seniors	%	Grad.	%	Total
C1	0	0.0	0	0.0	7	41.2	10	58.8	0	0.0	17

C2	2	33.3	0	0.0	1	16.7	3	50.0	0	0.0	6
C3	6	30.0	9	45.0	3	15.0	2	10.0	0	0.0	20
C4	0	0.0	2	33.3	1	16.7	3	50.0	0	0.0	6
C5	0	0.0	0	0.0	0	0.0	0	0.0	9	0.0	9
Total	8	13.8	11	19.0	12	20.7	18	31.0	9	15.5	

Results: Structural Model 1

Theoretical Model 1, see Figure 10, includes the constructs of collaboration training (training), work processes (relational link development and process structuring, and collaboration success (commitment, effectiveness, efficiency, process satisfaction, outcome satisfaction and productivity). In this model each of the constructs are further broken down into each individual variable in order to gain in-depth insight into these relationships. The analysis of this model looks to test the significance of the relationships between each variable within a construct. The first relationship tested, between training and each of the collaboration success variables, correlates with H1: *Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.*. The second relationship tested, between the training program and relational link development, correlates with H2a: *Members receiving the collaboration training program perceived increased instances of relational link group development judged against their most recent group project experience prior to receiving the collaboration training program*. The third relationship tested, between the training program and process structuring, correlates with H2b: *Members receiving the collaboration training program perceived increased instances of process structuring development judged against their most recent group project experience prior to receiving the collaboration training program*. The fourth relationship tested, between relational link development and each of the collaboration success variables, correlates with H3a: *Collaboration success increases as perceived instances of relational link development increases.* The fifth relationship test, between process structuring and each of the collaboration success variables, correlates with H3b: *Collaboration success increases as perceived instances of process structuring*

effectiveness increases. The sixth relationship test, focuses on the mediation effects of collaboration work processes, correlates with H4: *Members receiving the collaboration training program perceive greater collaboration success judged against their most recent group project experience prior to receiving training.*

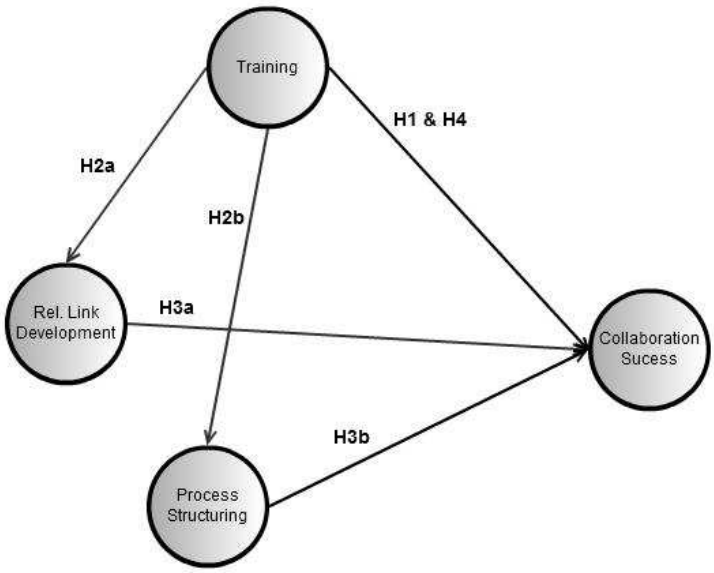

Figure 10: Structural Model I

Instrument Validity

The validity of the survey instrument used in this study was tested to ensure that positivist methods have been correctly identified and applied. For this purpose three key concepts are examined: content validity, construct validity, and reliability. Throughout this analysis the recommendations of Straub (1989) and Straub, Boudrea, and Gefen (2004) with regards to validity were followed.

There were three primary sets of questions found in the survey instrument utilized in the extended study. The first set focused on relational link development. These survey items were drawn from previous research in the field of virtual teams, thus verifying the content validity of the instrument. The instrument items relating to relational link development have previously been discussed by Lurey et al. (2009). They utilized a survey instrument which focused on several variables. The items relating to the development of team member relations were utilized for the survey, specifically questions 1, 3, 5, 8, 9, 10 & 1, in the first group of

questions. The second set of questions in the survey instrument focused on the development of process structuring within a virtual team. The questions in this set were developed by the researchers and were based on the core learning objectives found within the collaboration engineering design approach. The items relating to the development of process structuring within the survey are questions 2, 4, 6, 7, and 12 in the first group of questions. The validation of the process structuring section took place during the pilot study of this research. Within this study, factor analysis was used to analyze the survey instrument to validate that it was loading on two factors. The results indicated that the survey instrument was marginally loading on two factors, relational link development and process structuring. Thus the relational link and process structuring questions were revised.

To validate the revised survey instrument, a categorization activity was completed by 46 students. They were asked to sort the twelve relational link and process structuring questions into two categories, reflecting our two constructs. The results of this activity indicated that of the questions included, students were able to correctly categorize 12 of the 14 questions on average 85.51 % of the time. There were two questions in which the students identified incorrectly 55% and 65 % of the time. These two questions were eliminated. The number of relational link questions was set at 7. The number of process structuring questions was set at 5.

The third set of set of questions in the survey instrument focused on the collaboration success of the collaboration activity. These survey items were drawn from previous research in the field of collaboration, thus verifying the content validity of the instrument. The instrument relating to collaboration success was previously discussed by Duivenvoorde et al. (2009). They used a survey instrument evaluating the collaboration success of a collaboration activity based on the variables of satisfaction with the process, satisfaction with the outcome, commitment, efficiency, effectiveness and productivity. The survey by Duivenvoorde et al. (2009) was validated through the application of exploratory factor analysis, confirmatory factor analysis and Cronbach's alpha (Duivenvoorde et al., 2009). See Table 14 for a breakdown of the questions utilized in the Virtual Team survey and the correlating survey instrument.

Table 14: Virtual Team Survey Questions by category

Category	Questions	Validated Survey Instrument
Relational Link Development	1, 3, 5, 8, 9, 10 & 11	(Lurey & Raisinghani, 2001)
Process Structuring	2, 4, 6, 7 & 12	Pilot study and categorization activity
Collaboration Success		(Duivenvoorde et al., 2009)
Commitment	1, 6, 8 & 20	
Process Satisfaction	2, 4, & 7	
Outcome Satisfaction	3, 5 & 9	
Effectiveness	11, 15, 17 & 18	
Efficiency	12, 13, 14 & 16	
Productivity	10, 19, 21 & 22	

Construct validity focuses on the measurement between constructs. Factorial validity is important toward establishing the validity of latent constructs and is important when utilizing PLS (Gefen & Straub, 2005). If factorial validity is at an acceptable level, it can be determined that the measurement item correlates strongly with the construct it is related to and does not correlate significantly with other constructs. For the purpose of this research construct validity will be further broken down into two subsections: factorial validity-convergent validity and factorial validity – discriminant validity. These measurements will establish the goodness of fit of the measurement model. According to Gefen and Straub (2005, pg 93) "Convergent validity is shown when each of the measurement items loads with a significant t-value on its latent construct." Typically, the p-value of this t-value should be significant at least at the 0.05 significance level. Using PLS-Graph software, Smart PLS, the study examined 34 variables initially included in the survey instrument. The four items which exhibited loadings of less than the 0.7, as recommended in the literature, were then removed. (Gefen & Straub, 2005). Table 15 lists the items removed. The remaining items then represent the constructs which attest to the convergent validity of the instrument.

Table 15: Items exhibiting outer loadings below 0.7

Dimension	Item Code	Question
Collaboration Success	Effic4	I found the project worth the time and effort.
Process Structuring	Proc3	Our group had to revise the process or the project agenda some time during the project.
Relational Links	Rel1	During the group's first meeting, or discussion, some time was dedicated to group building exercises such as meeting individual group members, creating effective group communication, and/or discussing conflict resolution.
Relational Links	Rel3	I was able to contribute equally to the group's work.

Table 16 summarizes the results of the constructs comprising the model. Table 16 indicates the mean, standard deviation, outer model loadings, and the t-values of the model. The loadings for the resulting constructs are significant at $\alpha = 0.05$ significance. The t-value was estimated using a nonparametric bootstrapping procedure using 1000 samples (Chin, 1998). The t-values of the outer model loadings exceed 1.96 verifying the convergent validity of the instrument (Gefen & Straub, 2005).

Table 16: Results summary

Dimension	Item Code	Question	Mean	SD	Item Loading	t-statistic
Commitment	Com1	I had a stake in achieving the goal of the project.	4.34	0.77	0.7574	7.587
	Com2	I was willing to put my time and effort in the project.	4.32	0.73	0.8299	16.0024
	Com3	I was motivated to contribute to the project.	4.14	0.84	0.8617	17.1136
	Com4	I found the project important.	3.64	0.99	0.7084	7.2271
Effectiveness	Effec1	What we achieved as a group met my expectations.	3.89	1.02	0.9191	32.6273
	Effec2	The result of the project had the quality I expected.	3.91	0.90	0.8729	19.6317
	Effec3	We achieved what we intended.	3.99	0.93	0.9025	27.9073
	Effec4	The project result was as I hoped.	3.86	0.98	0.9098	27.1215
Efficiency	Effic1	The time and effort requested from me was reasonable.	3.97	0.95	0.8569	13.001

	Effic2	I was able to contribute relevant knowledge & experience I had.	4.16	0.79	0.8436	17.2065
	Effic3	The time and effort I spend on the project was what I expected.	3.80	1.04	0.8733	14.482
Outcome Satisfaction	OutSat1	When the project was over, I felt satisfied with the results.	4.08	0.86	0.9055	27.0335
	OutSat2	My group's accomplishments give me a feeling of satisfaction.	3.84	0.96	0.8897	25.9394
	OutSat3	I liked the outcome of our group project.	4.06	0.90	0.8893	18.6308
Process Structuring	Proc1	Our group established a process or a project agenda for achieving the project deliverables.	3.97	.93	0.8595	19.9422
	Proc2	Our group used a sequence or combination of collaboration activities to accomplish the project goals.	3.78	1.04	0.7471	8.3358
	Proc4	During the group's first meeting, or discussion, some time was dedicated to discussing the group's goals and objectives.	3.72	1.10	0.7289	7.393
	Proc5	Collaboration techniques, such as brainstorming or building consensus, were used for completing tasks during the project.	3.78	1.10	0.7624	9.5776
Process Satisfaction	ProcSat1	I felt satisfied with the procedures used by my group.	3.93	1.04	0.9408	48.4945
	ProcSat2	I felt satisfied with the way in which the project was conducted. I felt good about how the project progressed.	3.87	1.06	0.9097	17.3408
	ProcSat3	I felt satisfied about the way my group carried out project activities.	3.77	1.11	0.8856	21.0435
Productivity	Produc1	The project result was not a waste of my time and effort.	4.00	0.93	0.8074	10.1692
	Produc2	The input asked from me was in balance with the results.	3.87	0.92	0.8203	9.8895
	Produc3	What we achieved was worth the time and effort.	3.88	0.92	0.8568	14.5126
	Produc4	The quality of the project results justifies my input.	3.97	0.85	0.8112	13.2264
	Rel2	Knowledge and information sharing within my group occurred easily and regularly.	4.04	0.93	0.8001	12.9354

	Rel4	Group members had a shared understanding of what the group was supposed to do.	3.93	1.05	0.8545	11.9304
	Rel5	Group members trusted one another and would consult each other if they needed support.	3.91	1.08	0.8591	14.0858
	Rel6	Our group was a very cohesive unit.	3.71	1.15	0.8383	16.0501
	Rel7	When disagreements occurred, they were usually addressed promptly in order to solve them.	3.72	1.00	0.7971	11.2242

According to Gefen and Straub (2005) there are two criteria for testing discriminant validity. Criteria 1 requires that outer loadings should be larger than any other loadings. Upon verification that the outer loadings for each indicator was high (above 0.7), discriminant validity was then tested. As illustrated in Table 17 the instrument demonstrates criteria 1 for discriminant validity. Outer loadings in Table 17 are listed in bold, indicators are listed as rows and constructs are listed as columns.

Table 17: Outer loadings and cross loadings of model

	Commitment	Effectiveness	Efficiency	Proc-Struct	Productivity	RelLinkDev	Sat-Outcome	Sat-Process
Com1	**0.7574**	0.4581	0.6198	0.3577	0.4277	0.3879	0.4832	0.3943
Com2	**0.8299**	0.4887	0.5047	0.4781	0.4933	0.5222	0.4816	0.4656
Com3	**0.8617**	0.5846	0.6483	0.3938	0.5677	0.4757	0.5971	0.5289
Com4	**0.7084**	0.5161	0.4563	0.4076	0.61	0.4971	0.4395	0.4102
Effec1	0.5986	**0.9191**	0.6268	0.5816	0.7723	0.6744	0.839	0.7819
Effec2	0.5157	**0.8729**	0.5389	0.5186	0.7124	0.6405	0.7472	0.6551
Effec3	0.664	**0.9025**	0.5893	0.5765	0.7593	0.7282	0.8319	0.7468
Effec4	0.5576	**0.9098**	0.5507	0.5867	0.7443	0.7434	0.7757	0.7128
Effic1	0.4865	0.5835	**0.8569**	0.4377	0.5367	0.5053	0.615	0.6533
Effic2	0.7718	0.5635	**0.8436**	0.4266	0.5203	0.5623	0.5221	0.5115
Effic3	0.5098	0.4887	**0.8733**	0.3962	0.5001	0.444	0.5119	0.5193
OutSat1	0.5799	0.7838	0.5704	0.5637	0.6797	0.6489	**0.9055**	0.7883
OutSat2	0.5717	0.7773	0.5622	0.6345	0.7717	0.7532	**0.8897**	0.8159
OutSat3	0.5435	0.8207	0.5934	0.5012	0.7108	0.63	**0.8893**	0.6993
Proc1	0.4508	0.4981	0.4714	**0.8595**	0.514	0.6782	0.5412	0.5903
Proc2	0.3722	0.4597	0.396	**0.7471**	0.4359	0.5485	0.4292	0.4437
Proc4	0.4181	0.4454	0.2426	**0.7289**	0.477	0.5089	0.4672	0.3828
Proc5	0.3806	0.5461	0.3963	**0.7624**	0.4914	0.6287	0.5334	0.5124
ProcSat1	0.5749	0.7673	0.6285	0.6063	0.7199	0.7402	0.8261	**0.9408**
ProcSat2	0.5182	0.7107	0.6165	0.5839	0.6162	0.6882	0.8068	**0.9097**
ProcSat3	0.4667	0.7222	0.5459	0.5265	0.6267	0.6631	0.7215	**0.8856**
Produc1	0.5009	0.6468	0.4147	0.523	**0.8074**	0.6203	0.6587	0.5308
Produc2	0.5044	0.7192	0.5574	0.5374	**0.8203**	0.5979	0.7079	0.7049
Produc3	0.6832	0.7714	0.5685	0.5132	**0.8568**	0.5821	0.7033	0.6379
Produc4	0.5184	0.5911	0.4585	0.4593	**0.8112**	0.4951	0.5886	0.4876
Rel2	0.547	0.6448	0.5292	0.6938	0.59	**0.8001**	0.6315	0.6235
Rel4	0.5364	0.6785	0.4827	0.646	0.5834	**0.8545**	0.6345	0.5928
Rel5	0.5069	0.5722	0.4877	0.596	0.4804	**0.8591**	0.5916	0.5921
Rel6	0.4065	0.6617	0.4626	0.6305	0.6337	**0.8383**	0.6846	0.7708
Rel7	0.503	0.649	0.4971	0.6078	0.5997	**0.7971**	0.6091	0.5815

Criteria 2 involves AVE (average variance extracted) analysis. AVE measures the variance of the latent construct, indicating that the correlations of the construct with its measurement items should be larger than the correlations with other constructs (Gefen & Straub, 2005). The

AVE should be at least .50 (Fornell & Larcker, 1981). Table 18 lists the AVE and AVE^2 scores.

Table 18: AVE and square root values

	AVE	AVE2
Commitment	0.627	0.792
Effectiveness	0.812	0.901
Efficiency	0.736	0.858
ProcStruct	0.602	0.776
Productivity	0.679	0.824
RelLinkDev	0.689	0.830
SatOutcome	0.801	0.895
SatProcess	0.832	0.912

The AVE of each construct should also be larger than the correlation of the targeted construct with any of the other constructs in the model (Chin, 1998). Table 19 illustrates that the instrument demonstrates discriminant validity in that the diagonal values (bold) are greater than the corresponding correlation values.

Table 19: Square root of AVE scores and correlations of latent variables

	Commitment	Effectiveness	Efficiency	Proc-Struct	Productivity	RelLinkDev	Sat-Outcome	Sat-Process
Commitment	**0.792**	0	0	0	0	0	0	0
Effectiveness	0.6492	**0.901**	0	0	0	0	0	0
Efficiency	0.6981	0.6396	**0.858**	0	0	0	0	0
ProcStruct	0.5226	0.6289	0.4917	**0.776**	0	0	0	0
Productivity	0.6683	0.8292	0.6067	0.6184	**0.824**	0	0	0
RelLinkDev	0.6016	0.7748	0.5929	0.7667	0.6989	**0.830**	0	0
SatOutcome	0.6321	0.8863	0.6422	0.6374	0.8085	0.7616	**0.895**	0
SatProcess	0.5716	0.8044	0.6553	0.6282	0.7188	0.7652	0.8614	**0.912**

The last analysis to measure instrument validity in this research evaluates reliability. Table 20 summarizes the reliability results for the structural model constructs. Cronbach's α measures internal consistency and values exceeding 0.7 are recommended to establish

reliability. All constructs meet this requirement. Composite reliability also measures reliability and assumes that parameter estimates are accurate. Values exceeding 0.8 are recommended (Straub, Boudreau, & Gefen, 2004). All constructs also meet this requirement. As mentioned previously, the AVE measures also indicate that the recommended .05 value is exceeded. These three measurements attest to the reliability of the instrument.

Table 20: Summary of results for the inner model constructs

Construct	Code	Cronbach's α	Composite Reliability	AVE
Collaboration Commitment	Commitment	0.800	0.870	0.627
Collaboration Effectiveness	Effectiveness	0.923	0.945	0.812
Collaboration Efficiency	Efficiency	0.822	0.893	0.736
Process Structuring	ProcStruct	0.778	0.858	0.602
Collaboration Productivity	Productivity	0.843	0.894	0.679
Relational Link Development	RelLinkDev	0.887	0.917	0.689
Satisfaction with Collaboration Outcome	SatOutcome	0.876	0.923	0.801
Satisfaction with Collaboration Process	SatProcess	0.899	0.937	0.832

Internal Validity

The previous discussion focused on the validity of the survey instrument used in this research. The results of this analysis indicate that the survey instrument meets acceptable levels of content validity, construct validity and reliability. The study next established internal validity. Internal validity focuses on alternative hypothesis or explanations of any relationships found between constructs (Straub et al., 2004). The key question to this research

with regards to internal validity is whether the observed changes can be attributed to the proposed training program. Within this study the specific threat to internal validity lies in the single group research design. While there is a pre-test – post-test design, there is no control group. There were two mitigating factors as to the exclusion of a control group. There were two possible research designs within this study which could have been conducive to the inclusion of a control group. The first design would allow for a pre-test for all groups, the application of the training program to all groups except for the control group, the collaboration activity, and conclude with a post-test.

Due to the fact that this research was conducted within a small university setting, there were concerns with this design. In order to increase the completion rate for the training program, which was crucial because of small sample size concerns, the program was given to students for credit. In order to not violate human subject research concerns, all students were given the same opportunity to receive credit and complete assigned work in a class. The second design would allow for a collaboration activity and a post-test followed by application of the training program, another collaboration activity, and a post-test.

Difficulties with this design center on the use of two collaboration projects within a distributed course in one semester. Very few instructors currently use this type of format for their courses. The research design for this study used a pre-test to establish a baseline indicator for collaboration success in each participant's previous collaboration experience. The participants were asked to complete the survey instrument based on their previous experience with collaboration activities. The demographic information establishes that all participants have been involved in at least one group activity during the college career prior to this study. This establishment is then not related to one specific collaboration activity which could be impacted by a specific instructor, the task type or a specific group design. It reflects the participant's general and reflective feelings toward collaboration success outcomes from prior experience. It also reflects on their experience with relational links and process structuring. Another threat to internal validity is the threat that the participants would have had the same outcome without the training program. The turnaround time between the pre-test and the post-test was in most instances two weeks. Due to the quick turnaround time between the pre-test, the training program, and the collaboration activity it is reasonable to assume that

relational link and process structuring skills would not have matured on their own. A third threat to internal validity lies with the pre-test application itself. In some instances it is possible that utilizing a pre-test will give the participants an indication of the program and the study goals. Care was taken to make sure that the questions on both the pre- and the post- test were general enough as to not indicate the specific goals of the study. The questions were also randomized and repeated. For example, to establish the collaboration success variable productivity, four different questions were asked about productivity utilizing different methods. While this chapter discusses internal validity at the conclusion of this research process, it was actually of extreme importance during the research design process. This research seeks to establish internal validity to the extent that it can be controlled due to specific limitations imposed by sample size and basic human subject research guidelines.

Statistical Conclusion Validity - Structural Model 1

The first two sections in this chapter look to crucial elements toward positivist research. The study first established instrument validity and then discussed and established internal validity. The results of the study will now be analyzed toward establishing our hypothesis. In order to do this we relied on PLS analysis. The first evaluation of Structural Model 1, Figure 11, tested the relationship between the training program and collaboration success. The analysis looked at the significance between training and each of the collaboration success variables. Figure 11 illustrates the structural model of the training program with the R^2 values for each of the constructs. The path coefficients for this model are shown along with the correlating t-values ($p<0.05$) in parentheses. The significant relationships are shown with black lines, while those which were not deemed statistically significant are show with dashed lines.

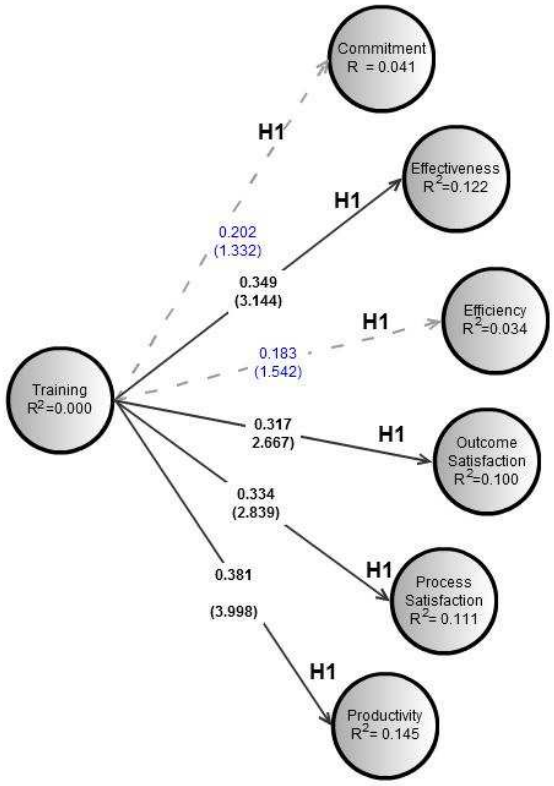

Figure 11: PLS results for Training Structural Model

The structural model for the training program indicates that there is a significant relationship between the training program and effectiveness, satisfaction with the outcome, satisfaction with the process and productivity supporting H1: *Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.* The strongest relationship is between the training program and productivity. The relationship between the training program and commitment and efficiency is not significant. It is difficult to ascertain as to why these two variables did not show a significant relationship. The one correlation that can be found within these two questions is that they could be directly related to the group project design and not the process utilized to complete the design. For example, one commitment question asks the participant if they found the project important. One efficiency question asks the participant if they found the project worth the time and effort. During some of the post-study interview sessions some of the students indicated that they were not satisfied with the overall project task itself:

"I don't care at all for this project. I don't see the benefit of it."

Other students felt the topic was too specific or too tailored to the skills of one participant:

"I am not sure how much I am really participating because of the topic of the project. It has been a waste of my time to try and contribute anything."

The correlating coefficient, t-value, path significance, and the hypothesis for each relationship tested by structural model 1 is listed in Table 21.

The second evaluation of structural model 1 includes a breakdown of the two key constructs: work processes and collaboration success. Figure 12 illustrates the structural model with the R^2 values for each of the constructs.

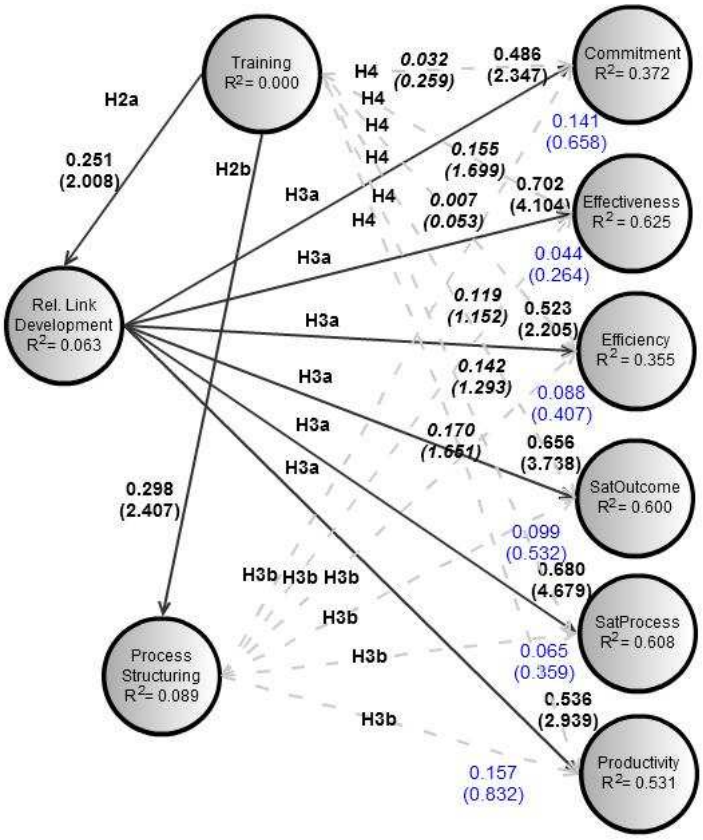

Figure 12: PLS results for the structural model

The path coefficients for this structural model are shown along with the t-values (p-value<0.05) in parentheses. The significant paths are show with solid, black lines. The correlating coefficients and t-values are also in bold text. The non-significant paths are shown with dashed lines. The correlating coefficients and t-values for the non-significant paths

between the process structuring and the indicators are in not bold. The correlating coefficients and t-values for the non-significant paths between the training program and the indicators are bold, italic.

Table 21: PLS results for the structural model

Relationship	Correlating Coefficient	t-value	Path Significance	Hypothesis
Training to Commitment	0.202	1.332	Not significant	H1
Training to Effectiveness	0.349	3.144	Significant[1]	H1
Training to Efficiency	0.183	1.542	Not significant	H1
Training to Outcome Satisfaction	0.317	2.667	Significant	H1
Training to Process Satisfaction	0.334	2.839	Significant	H1
Training Productivity	0.381	3.998	Significant	H1
Training to Relational Links	0.251	2.008	Significant	H2a
Training to Process Structuring	0.298	2.407	Significant	H2b
Rel. Link to Commitment	0.486	2.347	Significant	H3a
Rel. Link to Effectiveness	0.702	4.104	Significant	H3a
Rel. Link to Efficiency	0.523	2.205	Significant	H3a
Rel. Link to	0.656	2.205	Significant	H3a

[1] Significance for correlating t-values set at ($p<0.05$)

Outcome Satisfaction				
Rel. Link to Process Satisfaction	0.680	4.679	Significant	H3a
Rel. Link to Productivity	0.536	2.939	Significant	H3a
Process Structuring to Commitment	0.141	0.658	Not significant	H3b
Process Structuring to Effectiveness	0.044	0.264	Not significant	H2b
Process Structuring to Efficiency	0.088	0.407	Not significant	H3b
Process Structuring to Outcome Satisfaction	0.099	0.532	Not significant	H3b
Process Structuring to Process Satisfaction	0.065	0.359	Not significant	H3b
Process Structuring to Productivity	0.157	0.832	Not significant	H3b
Training to Commitment	0.032	0.259	Not significant	H4
Training to Effectiveness	0.155	1.699	Not significant	H4
Training to Efficiency	0.007	0.053	Not significant	H4
Training to Outcome Satisfaction	0.119	1.152	Not significant	H4
Training to Process Satisfaction	0.142	1.293	Not significant	H4
Training to Productivity	0.170	1.651	Not significant	H4

This second analysis of the adjusted structural model (Figure 12) establishes the significance of the relationships between several constructs. The results of this analysis support hypotheses H2a: *Members receiving the collaboration training program perceived increased instances of relational link group development judged against their most recent group project experience prior to receiving the collaboration training program* and H2b: *Members receiving the collaboration training program perceived increased instances of process structuring development judged against their most recent group project experience prior to receiving the collaboration training program*. The results indicate that there is a significant relationship between relational link development and the collaboration success constructs, thus supporting H3a. Contrary to our hypothesis, H3b, the relationships between process structuring and the collaboration success constructs were not significant, rendering a null hypothesis. The first adaption of Structural Model 1 (Figure 13) established the mediation effects of collaboration work processes in that with the addition of work processes to the structural model, the direct relationship between training and collaboration was insignificant. This analysis supports H4: *When the effects of relational link development and process structuring effectiveness are controlled for, there is no difference between the level of collaboration success reported by members receiving the collaboration training program judged against their most recent group project experience prior to receiving training.*

Based on the results of a null hypothesis for H3b and the small sample size these relationships were further examined through utilizing the same techniques discussed early in this chapter on a different structural model. The difference was within the combination of the collaboration success constructs. Instead of looking at each of the success variables individually they were combined into one single construct. The results of this analysis are detailed in the paragraphs below.

Interaction Effects

Having completed the examination of the overall relationships between the relational link development and process structuring on the collaboration success of the project, the next step was to examine possible interaction effects within any non-significant relationships. An

interaction affect involves a moderator variable which has a direct effect on the strength of the relation between a predictor variable and a criterion variable (Chin et al., 1996). A moderator provides additional information as to the different conditions in which a relationship between two variables can be expected to exist. Our previous analysis indicates that:

a) the relationship between training and collaboration success is significant, support H1.

b) the relationship between training and relational link development is significant, supporting H2a.

c) the relationship between training and process structuring is significant, supporting H2b.

d) the relationship between relational link development and the variables of collaboration success is significant, supporting H3a.

e) *the relationship between process structuring and the variables of collaboration success is not significant, rejecting H3b.*

f) *the relationship between training and collaboration success becomes insignificant with the inclusion of work processes, support H4.*

Thus the analysis of interaction effect focused specifically on H3b. The focus on this relationship was to better understand what impacts may be of importance to this relationship. In order to explore interaction affects the study utilized the demographic information gathered with the survey instruments. One of the difficulties within this process was the small sample size of certain demographics.

The demographic information includes demographics of the course in which the data was gathered as well as the individual participants. The data gathered included: course id, instructor id, gender, year in school, experience in an online course, experience with online collaboration activities and experience with collaboration activities. **Error! Not a valid bookmark self-reference.** lists the moderating variables which were explored.

Table 22: Moderating variables tested

Demographic	Moderator	Impact
Instructor ID	Instructor vs. Instructor	No significance
Gender	Male vs. Female	No significance
Online Experience	Experience vs. Inexperienced	No significance
Online Collaboration Experience	Experience vs. Inexperienced	No significance
Year in School	Freshman vs. all other grades	No significance
Year in School	Soph. vs. all other grades	No significance
Year in School	Junior vs. all other grades	No significance
Year in School	Senior vs. all other grades	No significance
Year in School	Grad. Student vs. all other grades	No significance
Year in School	Upperclassman vs. Underclassman	Significance[2] noted between ProcStruc & SatProcess

In this analysis there was one relationship which exhibited a change in significance. This relationship was found when the demographics were broken down as upperclassman (graduate students & seniors) and underclassman (freshman, sophomores and juniors) as the moderating effect. Within this evaluation it was noted that there was a significant relationship between process structuring and one of the collaboration success variables, satisfaction with the process.

Figure 13 displays the overall impact the graduate student moderator has on the relationships between process structuring and each of the collaboration success constructs.

[2] Significance for correlating t-values set at ($p<0.05$)

Significance was noted between process structuring and participant satisfaction with the process.

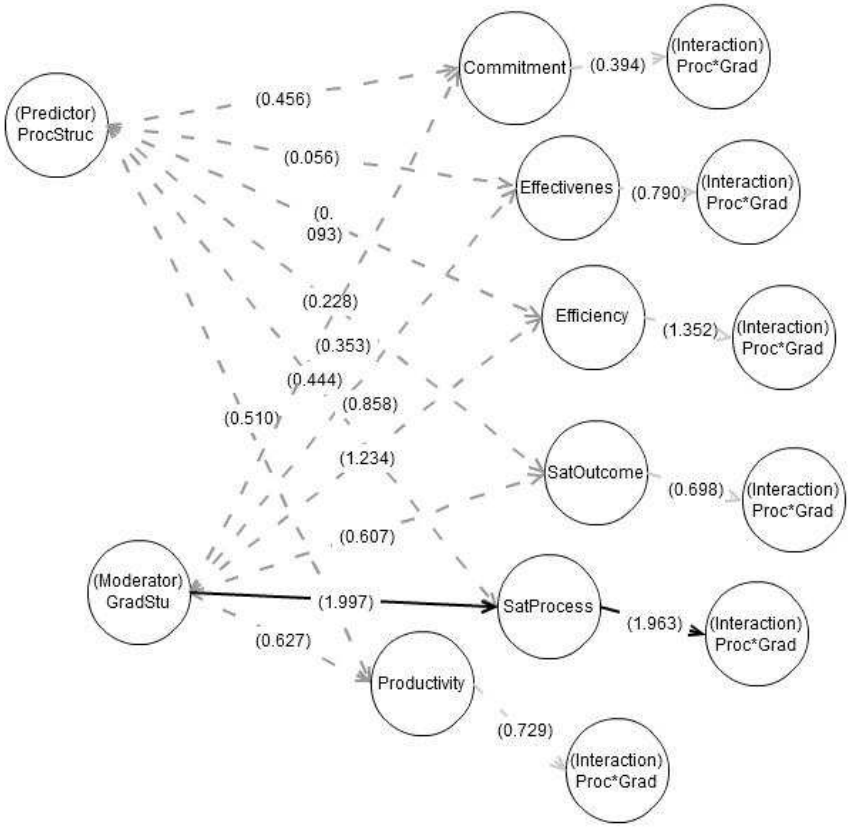

Figure 13: Upperclassman (graduate students & seniors) impact on Process Structuring relationships

Upon conclusion of the different statistical analysis it is important to look back and each of the outcomes and discuss exactly what each of the outcomes signify and focus on specific patterns and any additional data which may help to further explore and explain the results.

Instrument Validity – Structural Model 2

The study first looked to establish instrument validity through exploring construct validity, namely factorial validity - convergent validity and factorial validity – discriminant validity.

Using PLS-Graph software, Smart PLS, 34 variables initially included in the survey instrument were examined. At this point, twelve items which exhibited loadings of less than

the 0.7 as recommended in the literature, were removed (Gefen & Straub, 2005). Table 23 lists the items removed. The remaining items then represent the constructs which attest to the content validity of the instrument.

Table 23: Items exhibiting outer loadings below 0.7

Dimension	Item Code	Question
Commitment	Com1	I had a stake in achieving the goal of the project.
Commitment	Com2	I was willing to put my time and effort in the project.
Commitment	Com3	I was motivated to contribute to the project.
Commitment	Com4	I found the project important.
Efficiency	Effic1	The time and effort requested from me was reasonable.
Efficiency	Effic2	I was able to contribute relevant knowledge & experience I had.
Efficiency	Effic3	The time and effort I spend on the project was what I expected.
Efficiency	Effic4	The time and effort requested from me was reasonable.
Productivity	Produc4	The quality of the project results justifies my input.
Process Structuring	Proc3	Our group had to revise the process or the project agenda some time during the project.
Process Structuring	Proc4	During the group's first meeting, or discussion, some time was dedicated to discussing the group's goals and objectives.
Relational Links	Rel1	During the group's first meeting, or discussion, some time was dedicated to group building exercises such as meeting individual group members, creating effective group communication, and/or discussing conflict resolution.
Relational Links	Rel3	I was able to contribute equally to the group's work.

Table 24 summarizes the results of the constructs comprising the model. Table 21 indicates the mean, standard deviation, outer model loadings and the t-values of the model. The loadings for the resulting constructs are significant at $\alpha = 0.05$ significance. The t-value was estimated using a nonparametric bootstrapping procedure using 1000 samples. The t-values of the outer model loadings exceed 1.96 verifying the convergent validity of the instrument (Gefen & Straub, 2005).

Table 24: Results summary

Dimension	Item Code	Question	Mean	SD	Item Loading	t-statistic
Effectiveness	Effec1	What we achieved as a group met my expectations.	3.89	1.02	0.8962	26.0696
	Effec2	The result of the project had the quality I expected.	3.91	0.90	0.8138	11.6723
	Effec3	We achieved what we intended.	3.99	0.93	0.8804	22.5603
	Effec4	The project result was as I hoped.	3.86	0.98	0.8567	19.7936
Outcome Satisfaction	OutSat1	When the project was over, I felt satisfied with the results.	4.08	0.86	0.8500	15.8071
	OutSat2	My group's accomplishments give me a feeling of satisfaction.	3.84	0.96	0.8699	15.6618
	OutSat3	I liked the outcome of our group project.	4.06	0.90	0.8419	12.8701
Process Structuring	Proc1	Our group established a process or a project agenda for achieving the project deliverables.	3.97	.93	0.8760	26.1505
	Proc2	Our group used a sequence or combination of collaboration activities to accomplish the project goals.	3.78	1.04	0.7979	9.5641
	Proc5	Collaboration techniques, such as brainstorming or building consensus, were used for completing tasks during the project.	3.78	1.10	0.7715	7.292
Process Satisfaction	ProcSat1	I felt satisfied with the procedures used by my group.	3.93	1.04	0.8727	22.6526
	ProcSat2	I felt satisfied with the way in which the project was conducted. I felt good about how the project progressed.	3.87	1.06	0.8243	9.8732
	ProcSat3	I felt satisfied about the way my group carried out project activities.	3.77	1.11	0.7989	11.8603
Productivity	Produc1	The project result was not a waste of my time and effort.	4.00	0.93	0.7023	5.7991
	Produc2	The input asked from me was in balance with the results.	3.87	0.92	0.7884	10.4904
	Produc3	What we achieved was worth the time and effort.	3.88	0.92	0.7956	9.4888
Relational Link	Rel2	Knowledge and information sharing within my group occurred easily and regularly.	4.04	0.93	0.8020	13.7619

Development						
	Rel4	Group members had a shared understanding of what the group was supposed to do.	3.93	1.05	0.8514	13.8859
	Rel5	Group members trusted one another and would consult each other if they needed support.	3.91	1.08	0.8552	15.137
	Rel6	Our group was a very cohesive unit.	3.71	1.15	0.8459	19.477
	Rel7	When disagreements occurred, they were usually addressed promptly in order to solve them.	3.72	1.00	0.7931	12.9015

Upon verifying convergent validity, the next step was to analyze for discriminant validity. There are two criteria for establishing discriminant validity. Criteria 1 requires that outer loadings should be larger than any other loadings. Upon verification that the outer loadings for each indicator was high (above 0.7), The study then tested for discriminant validity. As illustrated in Table 25 the instrument demonstrates criteria 1 for discriminant validity. Outer loadings in Table 25 are listed in bold, indicators are listed as rows and constructs are listed as columns.

Table 25: Outer loadings and cross loadings of model

	Proc-Struct	RelLinkDev	Success
Effec1	0.5701	0.6757	**0.8962**
Effec2	0.4999	0.6414	**0.8138**
Effec3	0.5722	0.7291	**0.8804**
Effec4	0.5666	0.7435	**0.8567**
OutSat1	0.5366	0.6502	**0.8500**
OutSat2	0.6328	0.7553	**0.8699**
OutSat3	0.4713	0.6308	**0.8419**
Proc1	**0.8760**	0.7437	0.8727
Proc2	**0.7979**	0.6915	0.7767
Proc3	**0.7715**	0.6667	0.7678
ProcSat1	0.6209	0.6219	**0.8727**
ProcSat2	0.5805	0.601	**0.8243**
ProcSat3	0.535	0.5819	**0.7989**
Produc1	0.5222	0.7437	**0.7023**
Produc2	0.5172	0.6915	**0.7884**
Produc3	0.4553	0.6667	**0.7956**
Rel2	0.7103	**0.8020**	0.3083
Rel4	0.6312	**0.8514**	0.1645
Rel5	0.5776	**0.8552**	0.1127
Rel6	0.6499	**0.8459**	0.3313
Rel7	0.5768	**0.7931**	0.1038

Criteria 2 involves AVE (Average Variance Extracted) analysis. The AVE should be at least .50 (Fornell & Larcker, 1981). Table 26 lists the AVE and AVE^2 scores.

Table 26: AVE and square root values

	AVE	**AVE2**
ProcStruct	0.666	0.816
RelLinkDev	0.688	0.829
Success	0.692	0.832

The AVE of each construct should also be larger than the correlation of the targeted construct with any of the other constructs in the model (Chin, 1998). Table 27 illustrates that the instrument demonstrates discriminant validity in that the diagonal values (bold) are greater than the corresponding correlation values.

Table 27: Square root of AVE scores and correlations of latent variables

	Proc-Struct	RelLinkDev	Success
ProcStruct	**0.816**	0	0
RelLinkDev	0.7624	**0.829**	0
Success	0.6584	0.8119	**0.832**

The last analysis measures instrument validity with this structural model was to evaluate reliability. Table 28 summarizes the reliability results for the structural model constructs. Cronbach's α measures internal consistency and values exceeding 0.7 are recommended to establish reliability. All constructs meet this requirement. Composite Reliability also measures reliability and assumes that parameter estimates are accurate. Values exceeding 0.8 are recommended (Straub et al., 2004). All constructs also meet this requirement. As mentioned previously, the AVE measures also indicate that the recommended .05 value is also exceeded. These three measurements attest to the reliability of the instrument.

Table 28: Summary of results for the inner model constructs

Construct	**Code**	**Cronbach's α**	**Composite Reliability**	**AVE**
Process Structuring Development	ProcStruct	0.748	0.857	0.666
Relational Link Development	RelLinkDev	0.887	0.917	0.688
Collaboration Success	SatProcess	0.962	0.967	0.692

The analysis just completed established instrumentation validity in the revised structural model through an exploration of content validity, construct validity and reliability. Next, the results of the changed structural model on significance between various relationships will be examined.

Statistical Conclusion Validity – Structural Model 2

The second structural model was evaluated for the significance between training and collaboration success. Figure 14 illustrates the structural model of the training program with the R^2 values for the two constructs. The path coefficients for this model are shown along with the correlating t-values ($p<0.05$) in parentheses. The significant relationships are shown in black lines, while those which were not deemed statistically significant are show with dashed lines.

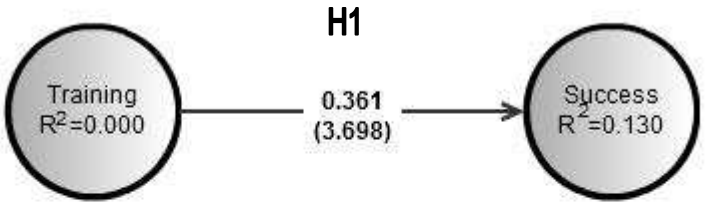

Figure 14: PLS results for Training Structural Model 2

The structural model for the training program indicates that there is a significant relationship between the training program and collaboration success. Figure 15 illustrates the structural model with the R^2 values for each of the constructs further broken down by process structuring and relational link development.

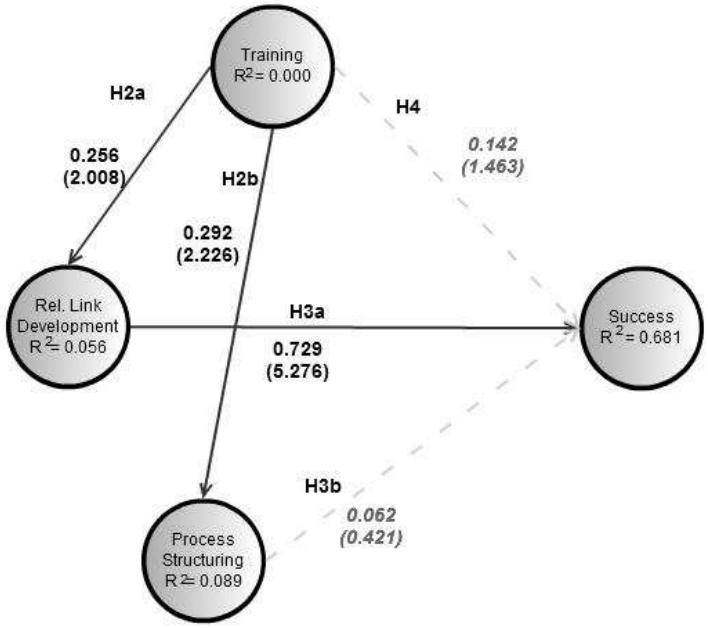

Figure 15: PLS results for Structural Model 2

The path coefficients for this structural model are shown along with the t-values (p-value<0.05) in parentheses. The significant paths are show with solid, black lines. The correlating coefficients and t-values are also in bold text. The non-significant paths are shown with dashed lines. The correlating coefficients and t-values for the non-significant paths between the process structuring and the indicators are not bold. Table 29 also breaks down the relationships.

Table 29: PLS results for the structural model

Relationship	Correlating Coefficient	t-value	Path Significance	Hypothesis
Training to Collaboration Success	0.361	3.698	Significant[3]	H1
Training to Relational Links	0.256	2.008	Significant	H2a
Training to Process Structuring	0.292	2.226	Significant	H2b
Rel. Link to Success	0.729	5.276	Significant	H3a
Process Structuring to Success	0.062	0.421	Not significant	H3b
Training to Success (Mediation)	0.412	1.463	Not significant	H4

The first analysis of structural model 2 (Figure 14) established the significance of the training program relationship to the combined collaboration success constructs. This analysis supports H1: *Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training.*. The second analysis of structural model 2 (Figure 15), which includes a further breakdown of the training program into relational link development and process shows that there is a significant relationship between the training program and the development of relational links and process structuring. This analysis supports hypotheses H2a: and H2b. The analysis then shows the relationship between process structuring and relational link development on collaboration success. The results again indicate that there is a significant relationship between relational link development and collaboration success, thus supporting H3a: *Collaboration success increases as perceived instances of relational link*

[3] Significance for correlating t-values set at ($p<0.05$)

development increases. Hypothesis H3b is also rejected in this model due to the relationship between process structuring and collaboration success not reaching significance, rendering a null hypothesis. The relationship between the training program and collaboration success also becomes insignificant with the addition of relational link development and process structuring to the model, this supporting H4: *When the effects of relational link development and process structuring effectiveness are controlled for, there is no difference between the level of collaboration success reported by members receiving the collaboration training program judged against their most recent group project experience prior to receiving training.* The next step toward understanding the results of this study was to explore the potential for any interaction effects which may be present. The interaction effects for this structural model were also evaluated in order to explore the potential for significant relationships between constructs based on demographic information. The results of this analysis revealed that there were no significant interaction effects in this structural model.

Discussion

In order to develop further understanding as to the results of this analysis, the results of the quantitative data were examined from different perspectives. Qualitative data was also used to further investigate the results. The results of the statistical analysis indicate that:

a) the relationship between training and collaboration success is significant, support H1

b) the relationship between training and relational link development is significant, supporting H2a

c) the relationship between training and process structuring is significant, supporting H2b

d) the relationship between relational link development and the variables of collaboration success is significant, supporting H3a

e) *the relationship between process structuring and the variables of collaboration success is not significant, rejecting H3b*.

f) *the relationship between training and collaboration becomes insignificant with the addition of work process constructs, support H4*.

An interaction affect between upperclassman was also noted in that underclassman reported satisfaction with the outcome in structural model 1. In order to explore what may have impacted these results four key areas were considered: application of the training program, the survey instrument, mediation effect, and interaction effects.

Application of Collaboration Training

The very first question that must be answered in this process is, "Did participants apply the techniques?" Very early this study determined that in order for participants to apply the techniques, they must learn them at a high level. Learning has been described as, "a change of state of a human being that is remembered and makes possible a corresponding change in the individual's behavior in a given type of situation" (Gagne, 1984). For the purpose of this research the revised version of Bloom's Taxonomy of Educational Objectives was utilized as an instructional design tool to develop the learning objectives of the training program and several corresponding levels of review activities for the training program.

The overall result of these activities indicates that at the conclusion of each module, students were able to exhibit each of the levels of learning within Bloom's revised taxonomy. While this utilization of Bloom's revised taxonomy is important and one of the unique aspects of the training program, it does utilize the taxonomy as a means for evaluating the learning outcomes of a collaboration activity. The utilization of the taxonomy in this research shows that learning to some extent did occur. But, at what level? Did participants reach the levels of applying, analyzing, evaluation and creating, as deemed by the taxonomy as necessary for this type of collaboration task? Ultimately what the study needs to determine is "Did participants learn how to apply relational link development and process structuring in a collaboration task at a high level?" Perhaps what is at issue here is that individual participants did not learn the process structuring techniques at a higher level, thus negatively impacting their perception of the role of process structuring in collaboration success. As one participant stated:

"I didn't think they were difficult when we went through them. But, I couldn't figure out how to apply them to problems. I am not sure that I was ever really applying them correctly."

The process structuring techniques involve a level of understand of the problem and how to apply the techniques to the problem. The relational link techniques on the other hand are fairly straightforward. More than likely individuals will reach the creating level of application very easily. They deal primarily with communication and establishing norms:

"the general do's and don'ts and development of relationships was a good thing to have because it reminds people of what they should do, even if it is mostly just common sense techniques."

While the training program did utilize the Bloom's revised taxonomy as an instructional design tool, it did not fully utilize the tool as an evaluation method to establish if participants truly learned to utilize the process structuring techniques within a collaboration activity. One way to answer this question would be to further utilize the taxonomy to classify the communication between group members during the collaboration activity. It would then be possible to evaluate this communication for the six levels of learning within the taxonomy. Upon the conclusion of this type of evaluation it would be possible to establish to what extent the training participants learned how to utilize the techniques from the training program. Without this establishment it is not possible to fully understand the lack of relationship between the process structuring techniques and the participant's perception of collaboration success within their collaboration activity. If it was established that a higher level of learning was not exhibited, small adjustments could be made to the training program itself.

While it is not feasible to require that the process structuring techniques are utilized in every collaboration activity, perhaps one way to further facilitate a higher level of learning within this training program is the requirement of these techniques in the first collaboration activity after the training program. This would further establish these skills within the participants as noted by one participant:

"maybe do less training before the group project but make some of the requirements of the group project be to use some of the techniques from the group training which will help the less experienced people."

It is also possible to change the format of the training program so that it is not a pre-collaboration activity:

"for me personally I would like to see the training program and the group project taught at the same time. So as we complete the modules we could then use that information and complete that task within our group project rather than doing sample activities alone."

Other participants indicated that just learning the techniques would not be enough at first:

"in order to use these techniques more, it will need to be a requirement at first. Otherwise people just want to jump into the activity and get it done."

The results of the quantitative analysis shows that participants felt the training program increased instances of process structuring and relational link development. It also showed that they felt that only the relational link development significantly impacted collaboration success. This could be directly related to the participant not reaching a higher level of understanding of the process structuring techniques. The end result is that they were able to utilize the survey instrument to report the lower level of understanding to say that these processes occurred, but were unable to evaluate how they impacted collaboration success. It is also possible that because the participants did not learn the process structuring techniques at a higher level, they did not apply them to the extent that the techniques would sufficiently impact the collaboration success of the project.

Limitations of the Survey Instrument

The second key impact focuses on the limitations of the survey instrument. The survey instrument is crucial to the outcome of this project. There are three sets of questions in the survey instrument which provide a breakdown of the constructs which are important to this research. These sections include process structuring, relational link development, and collaboration success. The third set of questions in the survey instrument specifically focuses on success factors from a participant's perspective based on six dimensions of success (Duivenvoorde et al., 2009). While this is one important aspect toward investigating the impact of relational link development and process structuring on a collaboration task, it is important to also consider additional perspectives which should be explored. Of particular interest is the comparison of the results of the survey instrument with the comments made by participants in post-collaboration interviews. This study establishes that the results of the survey instrument show that from a participant's perspective the training program increases instances of relational link development. Participant's comments also support this belief:

"I didn't utilize everything we did in the training program, but it was always in the back of my mind. As we worked through things and if we ran into problems I would reference the training program"

"for this group we had a great project manager, he really made sure that we used the group training techniques."

"Doing the group training made you think about it more than if I had not done it".

The results also indicate that participants felt that the development of relationships positively impacted the collaboration success of the project:

"we kind of used the discussion board to get to know each other and did a pretty good job of communicating."

The survey results then indicate that participants felt that the development of process structuring did not positively impact the collaboration success of the project. Some of the comments made by participants during participant interviews do not specifically support this outcome. Several participants indicate that their group did utilize process structuring during the project and that agenda did positively impact the group project:

"*once we got the agenda figured out and got the different aspects tasked out things went pretty well.*"

"*in our first meeting we outlined the tasks needed for each person to do so that everyone had a goal they could stick with and there wasn't any confusion. This helped things down the road.*"

The disconnect between the results of the survey instrument and the comments made by participants in the post-collaboration activity provide insight into the results which indicate that there is not a significant relationship between process structuring and collaboration success. The results of this insight are two-fold. First, perhaps our first key indicator, learning, is of importance here as well. If students did not truly learn the process structuring techniques during the training program, is it possible that they were not able to correctly indicate the impact they had on collaboration success? Perhaps they did not apply the techniques because they did not understand them. Second, would the creation of an additional evaluation instrument provide additional insight into the impact of process structuring? This evaluation instrument would again look to evaluate the communication of the group processes throughout the collaboration activity. Through this evaluation the participant's perspective was eliminated, which was shown to be conflicting. It may also be beneficial to explore the impact of process structuring on the outcome of the collaboration tasks.

Mediation Effects

The mediation effect specifically looks at the change in the relationship between the training program construct and the collaboration success construct once the work process construct is added. The results of the analysis show that the relationship becomes insignificant, supporting the argument that work processes mediate the relationship between collaboration training and collaboration success (H4). Some of the qualitative data previously mentioned helps to explain why or how this mediation effect is observed. One reason is that the training program provides students with a common knowledge of specific techniques gear toward collaboration activities. Another key area which shows an insight into these relationships is the interaction effect. As one participant stated:

"Sometimes you get into a group and don't know what to do first. Should we just jump right in? So sometimes it feels overwhelming. If you have some standard steps and techniques to fall back on that always helps the process."

Another reason is that the training program provides students with information and guidance about how a collaboration activity should progress before they participate in a collaboration group activity. This type of training may cause team members to think differently through the process about how to proceed:

"I didn't utilize everything we did in the training program, but it was always in the back of my mind. As we worked through things and if we ran into problems I would reference the training program"

Interaction Effect

The third key impact area to explore focuses on the interaction effect found when comparing the significance in relationships between different demographics of students. An interaction affect involves a moderator variable which has a direct effect on the strength of the relation between a predictor variable and a criterion variable (Chin et al., 1996). There were a

number of different demographics evaluated for their impact on relational link development and process structuring. Table 30 lists these moderators.

Table 30: Moderating variables tested

Demographic	Moderator	Impact
Instructor ID	Instructor vs. Instructor	No significance
Gender	Male vs. Female	No significance
Year in School	Freshman vs. all other grades	No significance
Online Experience	Experience vs. Inexperienced	No significance
Online Collaboration Experience	Experience vs. Inexperienced	No significance
Year in School	Soph. vs. all other grades	No significance
Year in School	Junior vs. all other grades	No significance
Year in School	Senior vs. all other grades	No significance
Year in School	Grad. Student vs. all other grades	No significance
Year in School	Grad Student & Seniors vs. other grades	Significance[4] noted between ProcStruc & SatProcess

The first moderator tested was instructor ID. There were three different instructors which participated in this research. All three instructors were evaluated to see if they had any impact on the results. The results were consistent with the analysis of the structural model in that significant relationships were noted between the training program and relational link development (H2a) and process structuring (H2b). The results also demonstrate that the relationship between relational link development and collaboration success constructs (H3a) was significant, while the relationship between process structuring and collaboration success constructs (H3b) was not significant.

The second moderator tested was gender. There were exactly 29 males and 29 females which participated in the study. The results were again consistent with the analysis of the structural model with regards to significance in relationships. The third and fourth moderators tested were experience in an online course and experience with a collaboration activity. The

[4] Significance for correlating t-values set at ($p<0.05$)

results were again all consistent with the analysis of the structural model with regards to significance in relationships.

The last moderator tested was year in school. We evaluated the overall moderating effects as well as each grade against the group. Within this evaluation all of the results were again consistent with the analysis of the structural model with regards to significance in relationships, except graduate students against undergraduate students. In this instance, the study found that there was a significant relationship between process structuring and the collaboration success construct of satisfaction with the process in the combination of graduate students and seniors versus freshman, sophomores and juniors. Duivenvoorde et al. (2009) explain satisfaction as the perception by an individual, that if the likelihood of an individual goal are advanced by a group effort, a positive satisfaction response is likely to occur. To understand what may have impacted this development a few key characteristics of the graduate student & seniors (upperclassman) against the freshman, sophomores and juniors (underclassman) were examined. The upperclassman consisted of 18 seniors and 9 graduate students. There were 20 males in the group and 7 females. Of this group, only 4 students reported that they had not taken an online course before. Of the students who had taken online courses before, 4 reported that they had not previously worked on a collaboration group project in a distributed environment, 8 reported that they had worked on 1 -2 group projects in a distributed environment, and 11 students reported that they had worked on 3 or 4 group projects. The underclassman consisted of 9 males and 22 females. Of this group, 7 students reported that they had not taken an online course. Of the students who had taken online courses before, 16 reported that they had not previously worked on a collaboration group project in a distributed environment, 4 reported that they had worked on 1 -2 group projects in a distributed environment, and 2 students reported that they had worked on 3 or 4 group projects. Table 31 lists the breakdown of the demographics between the two groups.

Table 31: Demographic breakdown of upperclassman vs. underclassman

Demographic	Upperclassman	Underclassman
Males	20	9
Females	7	22
# of students who have not taken an online course before	4	7
# of students who have taken an online course before	23	24
# of students who have not worked on a online collaboration activity	4	18
# of students who worked on 1 -2 online collaboration activities	8	4
# of students who worked on 3-4 online collaboration activities	11	2

Two areas which stand out in these numbers are gender and the experience level of the participants in online courses. In general it is difficult to ascertain the impact that these demographic differences has on the results of the survey. Gender is an extremely difficult demographic to explore as there are many different correlations which can be made. When looking at the overall interaction effect of gender, there was no significance reported. The second area which can provide this research with some insight lies within the difference between the overall online collaboration experiences in the two groups. The upperclassman reported that they had more experience in working on a collaboration activity within a distributed environment. What this may indicate is that to the novice collaboration participant there is somewhat of an overload of information and techniques when it comes to effectively facilitating and participating in their first few collaboration activities. Novices may also be unaware of the difficulties which can occur in an online collaboration activity. More experienced practitioners may be aware of these concerns and able to process the techniques offered in the training program in correlation with their past experiences. This again may relate back to our previous discussion in which learning was discussed. The novice practitioner may benefit the most from specific techniques and evaluations which help to guarantee that they establish a higher understanding of the material.

Summary

The focus of Chapter 7 is to provide in in-depth analysis of the results and discussion from the second part of the extended evaluative campaign, the extended study. The first section of the chapter focuses briefly on the analysis technique, PLS, which was utilized as the analysis method for this research. PLS analysis exhibits a good fit with this research in that it has minimal demands on measure scales, sample size, and residual distributions. The next section outlines an overview of the data found in this research. The focus of this section is to describe the primary demographics found within the data. The next main section explores the results of the analysis of the first structural model, Structural Model 1. Structural Model 1 includes the constructs of collaboration training, work processes and collaboration success. The construct of work processes is broken down into relational link development and process structuring development. The construct of collaboration success is broken down into commitment, process satisfaction, outcome satisfaction, effectiveness, efficiency and productivity. The evaluation of Structural Model 1 begins by evaluating instrument validity through exploring content validity, construct validity, reliability and internal validity. It was found in this analysis that each aspect of instrument validity is supported. Structural Model 1 is then evaluated for statistical conclusion validity. This analysis specifically provides information about the relationships between constructs relating to each of the hypothesis in Chapter 6. It was found that that the results support H1, H2a, H2b, H3a and H4. The results do not support H3b. A moderating affect was also found in the analysis of Structural Model 1. The next main section explores the results of the analysis of the second structural model, Structural Model 2. Structural Model 2 includes the constructs of collaboration training, work processes and collaboration success. The construct of work processes is broken down into relational link development and process structuring development. The construct of collaboration success is not further broken down. The evaluation of Structural Model 2 begins by evaluating instrument validity through exploring content validity, construct validity, reliability and internal validity. It was found in this analysis that each aspect of instrument validity is supported. Structural Model 2 is then evaluated for statistical conclusion validity. This analysis specifically provides information about the relationships between constructs relating to each of the hypothesis in Chapter 6. It was found that that the results again support

H1, H2a, H2b, H3a and H4. The results do not support H3b. A moderating affect was not found in the analysis of Structural Model 2. The chapter concluded with a brief discussion. In this discussion the answers to the research questions are explore through an analysis of the quantitative and qualitative results in four key areas: application of the training program, the survey instrument, the mediation effect and interaction effects.

CHAPTER 8

Conclusion

This chapter briefly reviews the information discussed to this point and then provides a discussion of the findings and their implications. The chapter also discusses future work in the field. To provide an overall picture of the study, the discussion begins with a look back through the research progression.

Research Progression

The need for this research study was established through several defining factors. Throughout the last decade there has been a fundament shift in how people and organizations work. Organizations have moved toward a globalized network due to advances in communication and network technologies (Prasad & Akhilesh, 2002). This movement has caused organizational strategies to utilize global expansion, foreign-based sub-contracting of labor, and telecommuting (Jarvenpaa & Leidner, 1999). Evolving through this process is the utilization of virtual project teams for many processes including product development, computer support and test centers (Prasad & Akhilesh, 2002). Virtual team utilization allows organizations to benefit by providing opportunities to leverage skills from different locations across the globe to innovatively solve problems and create ideas. The benefits of virtual teams can only be realized through an effective process. There are several factors within the characteristics of a virtual team which can add complexity to this process. These characteristics include reliance of communication technologies, geographic dispersion, inexistent time/space boundaries, cultural differences, and the swift-starting nature of virtual team projects. Several difficulties can result due to these characteristics:

a) poor team member satisfaction
b) lack of coordination and communication effectiveness
c) lack of development of trust amongst team members

d) inconsistent team member expectations. (Powell et al., 2004)

The research has established that organizations are going global and they are relying on virtual teams for varying processes. Effective virtual teams can greatly benefit organizations. Several difficulties found within the characteristics of virtual teams can impede their success. One way to overcome these difficulties is to provide knowledge workers with the skills necessary to effectively collaboration in a virtual team.

In order for knowledge workers to be effective in a virtual team they need to establish the necessary skill sets to overcome difficulties inherent to virtual team collaboration. Two areas within current research on virtual teams which look to provide collaboration techniques are relational link development and process structuring. Lurey and Raisinghani (2001) indicate that a teams' processes and team members' relations present the strongest relationships with effective team performance and team satisfaction. Munkfold & Zigurs (2007) found in their evaluation of swift-starting virtual teams that it is necessary for virtual teams to structure their interactions, which included process structuring activities such as discussing project goals and deliverables, defining roles and responsibilities and setting milestones, in order to be effective. Given the varying nature of collaboration tasks, virtual teams and the growing reliance on communication and collaboration technologies available, there is a need for an effective training program for novice practitioners which prepares them to conceive and employ structured collaboration processes, while establishing strong relational links with teammates, resulting in improved overall collaboration success of the virtual team. Thus the overall research question of this study was "*Will a collaboration training program increase instances of relational link development and process structuring tasks to improve overall collaboration success.*"

The individual hypotheses were as follows:

- *H1: Improved collaboration success will be noted for members receiving collaboration training program, judged against their most recent group project experience prior to receiving the training..*

- *H2a: Members receiving the collaboration training program perceived increased instances of relational link group development judged against their most recent group project experience prior to receiving the collaboration training program.*
- *H2b: Members receiving the collaboration training program perceived increased instances of process structuring development judged against their most recent group project experience prior to receiving the collaboration training program.*
- *H3a: Collaboration success increases as perceived instances of relational link development increases.*
- *H3b: Collaboration success increases as perceived instances of process structuring effectiveness increases.*
- *H4: When the effects of relational link development and process structuring effectiveness are controlled for, there is no difference between the level of collaboration success reported by members receiving the collaboration training program judged against their most recent group project experience prior to receiving training.*

The first three hypotheses (H1, H2a & H2b) are directly related to the first two key contributions from this research, the collaboration training theoretical model and an instructionally designed training program. The theoretical model builds upon previous research in virtual teams. The theoretical model first looks to understand the impact of the training program on process structuring and relational link development. Each module within the collaboration training program has a foundational theory for its basis. The first module, *Module 1: Orientation and Trust Building*, leverages the team performance model (TPM) developed by Drexler et al. (1988). Modules two through six of the collaboration training program leverage process structuring techniques using the collaboration engineering (CE) process design approach. The second key contribution of this research is the instructional design of the training program artifact and the artifact itself. The instructional design process utilized demonstrated benchmarks for learning outcomes to establish objectives and activities for each module within the training program. This contribution is unique in that many training programs do not include this process. The hypotheses H2a and H2b were evaluated in both

the pilot study and the extended study. The pilot study focused on an evaluation of the feasibility of the training program as well as the establishment of a significant relationship between the collaboration training program and increases instances of process structuring and relational link development. The results of the pilot study indicated that the feasibility of the training program was at an acceptable level and there was a significant relationship between the training program and the increased instances of relational link development and process structuring. These results indicated that the research could move forward to the extended study. The extended study looked to evaluate the second two hypotheses.

Hypothesis H3a and H3b are directly related to the third key contribution from this research, an evaluation process which explores the impact of perceived increased instances of relational link development and process structuring on collaboration success. The extended study built upon the results of the pilot study. The pilot study was crucial in that it established that the collaboration training program did have a significant relationship with relational link development and process structuring. Without this relationship it would have been difficult to move forward. The extended study then looked to further establish the impact this relationship had on collaboration success. In order to establish the significance of the relationship between relational link development and process structuring an evaluation tool was developed and tested.

Having taken a brief look back through each step of this research the findings of the research will be discussed and analyzed.

Findings

The main findings came from the results of the hypothesis testing of the training program in the pilot study and the extended study, which indicated the significance between relationships.

Answers to the Research Questions

Our overall research questions can be answered as follows:

1. Utilization of the collaboration training program as a virtual team, collaboration training program correlates with increased instances of relational link development.
2. Utilization of the collaboration training program as a virtual team, collaboration training program correlates with increased instances of process structuring.
3. Increased instances of relational link development have a significant relationship with collaboration success.
4. Increased instances of process structuring do not have a significant relationship with collaboration success.

The Collaboration Training Program

One of the key findings within this study is that there is a significant relationship between the collaboration training program and increased instances of relational link development and process structuring. These findings are consistent in the pilot study as well as the extended study. In this study a training program has been built with the following key characteristics:

- develops relational link facilitation skills in novice practitioners
- develops process structuring skills in novice practitioners
- is flexible across platforms
- is theory based
- is learner focused

The collaboration training program utilized the TPM to establish in novice practitioners the skills to development relational links through a serious of steps. This finding is in line with Warkentin and Beranek (1999), who found that relational links can be developed through such steps as defining member roles and establishing consistent patterns of communication. Our findings also support the suggestion by Warkentin and Beranek (1999) that if virtual teams are given team communication training, they will develop stronger relational links than teams that do not receive training. Relational link development fosters and maintains the occurrence of trust in virtual teams. Virtual teams that exhibit high trusting behaviors experience significant social communication as well as predictable communication

patterns, substantial feedback, positive leadership, enthusiasm, and the ability to cope with technical uncertainty (Jarvenpaa & Leidner, 1999).

Relational link development is one of the factors which some novice practitioners do not value as a significant contribution to the collaboration task. Many times they would rather jump right into the task and overlook the development of relational links (Munkvold & Zigurs, 2007). In a face to face environment relational link development is more of a byproduct of the environment than a technique utilized for collaboration. The collaboration training program establishes within the participants not only an understanding of how to develop relational links in a distributed environment but also establishes an understanding of why it is important to develop relational links. Many participants felt that the ideas established during the pre-collaboration training program were always in the back of their minds throughout the training program.

Relational link development skills are important skills which need to be fostered in novice practitioners. While they are important, they are not inherently difficult. Process structuring skills and techniques are more advanced. The collaboration training program utilized a revised version of the collaboration engineering approach to develop process structuring skills in novice practitioners. The revision simplified many of the techniques, such as reducing the number of thinkLet's available to practitioners. The skills necessary to properly facilitate a collaboration activity are not inherent to most individuals. They, like relational link development skills, need to be fostered within these individuals. These findings support Kolfschoten and de Vreede (2007) in that their approach provided support for novice collaboration engineers, created insight into the steps within the collaboration process, provided a starting point for creation of design support tools, and provided a basis for the training. Our findings also support the indications by Tarmizi et al. (2007) that there is a need for a "pre-training" program toward encouraging team members to think differently about virtually collaborating. Participants again indicated that during the collaboration activity they always kept the techniques and processes in the back of their mind, especially when they ran into difficulties.

Collaboration Success

Having established that the collaboration training program does in fact increase instances of relational link development and process structuring in novice practitioners, the next step was to evaluate how these developments impacted the outcome of the collaboration task. This evaluation focuses on what was termed by Duivenvorde et. al (2009) as collaboration success. They defined successful collaboration as, "the appreciation of joint effort and its outcome by relevant stakeholders." Within collaboration success there are six defined constructs: commitment, effectiveness, efficiency, satisfaction with the outcome, satisfaction with the process and productivity.

The study first established that the collaboration training program itself had a significant relationship between four of the six collaboration success variables. The two constructs which were not supported were commitment and efficiency. In this context commitment is defined as a force with encourages an individual to spend time, effort, knowledge and physical resources to achieve the group goal (Duivenvoorde et al., 2009). Efficiency is defined as the difference between the actual amount of resources used compared to the expected amount of resources (Duivenvoorde et al., 2009). This finding is in line with Duivenvoorde et. al (2009) in their belief that it is often the case that an increase in the success of one construct can decrease success on another dimension. It is also possible that these two constructs were closely associated by participants with the task itself rather than with the collaboration process or the outcome of the collaboration task. Several of the participants did indicate that they did not like the task itself or that they felt they did not have the required knowledge needed to complete the task. This would negatively impact their feelings toward commitment and efficiency. If individuals do not feel that they have the skills to help develop the task itself they may feel negatively toward commitment in that they are not available to contribute knowledge toward the group goal. This may also negatively impact efficiency in that participants may feel that they are spending a lot of time trying to make up for their lack of knowledge by quickly trying to establish the knowledge. They may also feel the opposite and that they expected to be able to contribute to the project, but other team members with more knowledge in essence took over that aspect of the process. The four variables which did exhibit significant relationships are: effectiveness, satisfaction with the

outcome, satisfaction with the process, and productivity. These four variables, which can be related to the task itself, may not be. Participants may support these outcomes in that they did find success in the process and were able to see value in the product. Perhaps they were able to eventually work through any issues they had with the task design and establish means for working toward the group goal. These findings establish that the training program as a whole does have a significant relationship to the overall collaboration success of the collaboration task. To further understand these findings it is important to explore a breakdown of the training program into the relationships found between relational link development and the collaboration success constructs, and the relationships found between process structuring and the collaboration success constructs.

Relational link development supports many of the socioemotional needs of participants in a collaboration activity toward the development of trust amongst team members. Trust can increase confidence and security within team member relationships and encourage an environment in which information can be open and freely exchanged (Jarvenpaa et al., 1998). Our findings show that there is a significant relationship between the development of relational links and each of the six collaboration success variables. The collaboration success variables define success from the participant's point of view. Toward this end they were able to see how relational links can positively affect a collaboration task during the process of working through the task as well as the task outcome. It is interesting to note that when looking at just the relationship between relational link development and collaboration success, all six of the collaboration success variables show a significant relationship. This suggests that the design of the task or the participants perceived shortcoming of the task did not impact their correlation between commitment and efficiency. Relational link development may have actually allowed them to overcome this perception in that they saw added value to their contributions. For example, one participant who felt she could not contribute to the task was encouraged by her team members to be more involved in the organization of the project rather than the development of the task itself. The task at hand was the coding of a website. She felt comfortable enough with her teammates to share this concern with them. She did not have the same level of knowledge of coding as the other team members. Her teammates positively responded by creating a role for her that was more of a

project manager. At this point she gave away her frustration with her lack of knowledge and inability to contribute as much to the task as the rest of the group instead of just accepting the fact that she could not contribute. Once she became the project manager she was able to be a part of the process and see her contribution. In this example we can see team members communicating each other and supporting each other rather than just getting frustrated with the project and with other members. This outcome is important as the study seeks to demonstrate that one key characteristic of a pre-collaboration training program was the development of relational links. This importance is demonstrated in the perceived positive impact of this development on the success of a collaboration activity from the participant's point of view.

The second important outcome of this research is to establish that the development of process structuring skills within a novice practitioner would positively impact the collaboration success of the task from the participant's perspective. While the findings support that the collaboration training program did increase instances of process structuring within a collaboration task, the study was unable to show that this development had a significant relationship with the participant's feelings of collaboration success. This outcome is important in that participants were not able to make the connection between increased feelings of collaboration success with the additional process structuring which occurred. The primary focus of the process structuring skill developed within the notice practitioners was to provide them all with a consistent starting point and structured, repeatable techniques which could be utilized to facilitate the collaboration task. There are potential reasons as to why this disconnect occurred.

It is possible that although participants reported that they were utilizing more process structuring techniques after the training program, this utilization was extremely basic because they did not truly establish a high enough understanding of the techniques according to Bloom's taxonomy to apply them. Participants reported that they did brainstorm about ideas, and that they utilized an agenda. Some participants even indicated that they were looking to utilizing these techniques and processes in other collaboration groups in other classes or within other extra-curricular activities. While this is a positive step in the right direction, it is not a big enough step to show an impact on the overall collaboration success of the task. In

order for process structuring to impact the outcome of the collaboration success of the project, the participants need to understand how to best utilize these techniques. They also need to see the benefit of the utilization of these techniques. Otherwise they will feel that it is extra work that does not serve any purpose. A higher level of understanding of the techniques will increase their comfort level with the techniques and help overcome those perceptions that they are just more work. In a study by Tarmizi et al. (2006) in which they studied the utilization of the collaboration engineering design approach, they found that participants had difficulty understanding some of the processes and techniques in the approach. They suggested that future researchers provide a pre-collaboration training program to help overcome this perceived difficulty. Our findings may support that a pre-collaboration training program is not enough to overcome this difficulty. A higher level of learning may need to be established before participants will see an impact on collaboration success. This idea may be supported by the findings that there was an interaction affect between upperclassman and underclassman on the significance between relational link development and satisfaction with the process. The participants in the upperclassman group had more experience with virtual team collaboration. This may indicate that their previous experience provides them with an understanding of how virtual teams work and the ability to foresee the need for structure within these tasks. They may have also exhibited a higher level of understanding of the processes because they did not have the added stress of trying to understand the technology tool or navigate the virtual world for the first time. The survey instrument utilized for the evaluation of this tool focuses on the individual participants perceptions toward collaboration success. The outcomes of our study are important as this established that more work needs to be done to develop a higher level of learning of these techniques in participants. What it may have also established is that there is a need to first understand to what level the participants are utilizing these techniques before the impact on collaboration success can be evaluated. It may also be important to evaluate the impact of these techniques from a different perspective. Individual participants may not feel that there is benefit to these techniques, but the resulting deliverable may indicate otherwise.

The findings are important toward developing a better understanding of the impact of process structuring and relational link development on the collaboration success of a virtual team. The study was able to establish that the collaboration training program established

higher instances of relational link development and process structuring in virtual teams. The study was also able to establish that the increased instances of relational link development had a significant relationship with collaboration success. The study was not able to establish that increased instances of process structuring had a significant relationship with collaboration success. The results can lead to several implications of this study.

Implications of the Study

The findings of this research imply several consequences for researchers and individuals interested in utilizing virtual teams for collaboration tasks:

- A collaboration training program is necessary toward establishing the development of relational links in novice practitioners.
- Relational links can help novice practitioners overcome some of the difficulties found within virtual teams which can prohibit collaboration success.
- A collaboration training program is necessary toward establishing the development of relational links in novice practitioners.
- Studying the relationship between process structuring and collaboration success may provide more insight into the outcome of a collaboration activity.
- The utilization of Bloom's taxonomy to design educational objectives and activities is one step toward understanding participant learning of relational link development and process structuring skills which provides insight into the importance of this step as well as the need for further establishment of learning.
- Steps should be taken to ensure that participant learning reaches a higher level of learning of process structuring.
- The utilization of a collaboration training program alone is not enough to establish a high level of understanding of process structuring techniques.

These implications will help researchers in designing training programs and techniques which will impact programs designed to foster relational link development and process

structuring skills in novice practitioners. It will also help researchers look for ways to further evaluate the impact of process structuring on multiple outcomes of a collaboration activity. These implications can contribute both to research within the business environment and the education environment. Within the business environment they continue the research previously found within group decision support systems and collaboration engineering. These two fields focus specifically on how to provide structure and support through prescribed techniques for a collaborative activity. The implications found in this study begin to provide insight into how to implement these techniques to successfully implement and design training programs for distributed collaborative activities. Within the education environment the implications within this study look to bridge educational objectives with proven business processes toward the application of distributed collaborative efforts to improve outcomes.

Future Work

Our study has focused on answering questions which can shed some light on future research in the area of virtual team collaboration. First, future research should focus on establishing a higher level of learning of process structuring techniques in novice practitioners. This research needs to include an in-depth analysis of the use of process structuring techniques within a collaboration task. This will establish the level of learning which participants exhibit after concluding a training program built around collaboration engineering techniques. Upon this establishment it would be possible to adjust the training program toward increasing participant's level of learning if deemed necessary. Adjustments which could be made would be to include a virtual team collaboration task within the training programs. Participants would first focus on learning specific techniques as an individual. They would come away from these individual activities with a basic level of understanding of these techniques. Participants would then, as part of the training, participant in a virtual collaboration task which would allow them to further apply these techniques in an environment which includes the elements of team work and task deliverable in a virtual environment. This application should then help practitioners reach a high level of learning of

the techniques which can in-turn help them utilize these techniques on their own , based on their knowledge and experience with them.

At the same time future research needs to develop techniques and methods for truly establishing the level of understanding of the techniques offered in a training program as well as establishing evaluation tools specifically geared toward process structuring. Many of the studies and the tools involved in virtual team research focus on the impact of relational link development and process structuring from the participant's point of view. While this point of view is extremely important, it is not the only point of view worth exploring. Much work can be done in the area of process structuring. While process structuring techniques are not necessary new to the research field, their application to the virtual collaboration environment is relatively new. To date many researchers are struggling to make sense of the impact of process structuring on collaboration activities. There is a belief that there is an impact, but research has failed to come up with a prescription as to how to best facilitate these techniques and evaluate them.

One of the primary goals with this research is to provide insight and building blocks for future work within the areas of GDSS, CE, virtual teams, and online education. The unique aspect of this research is that it looks to research within the fields of information systems and online education to provide training techniques which can benefit virtual team utilization in the business and the education environment. Within the business environment, GDSS and CE techniques have provided support for collaborative activities but have proven difficult to sustain. Within GDSS and CE current research is beginning to look at how to improve the sustainability of these techniques through their implementation and application within a distributed environment. This research is one more step toward understanding how to facilitate these techniques with novice practitioners through training, as well as the impact of their utilization by the novice practitioner. The unique aspect of the training program is the utilization of educationally based benchmarks for the development of the training program within the business environment. Within online education, several techniques and processes have been utilized toward improving collaborative outcomes. Many of the studies of these techniques have taken place within the educational environment, but have not looked to contribute to the body of knowledge within the field of education, specifically online

education. Future work in the fields of GDSS, CE, virtual teams, and online education can use the lessons learned in this research to further contribute to the vast bodies of knowledge looking to provide insight into the utilization of collaboration in distributed environments and the impact of that utilization.

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APPENDICES

Appendix A: Group Training Program

Group Training Introduction

Wednesday, November 18, 2009

11:50 AM

Welcome to the group training program. This program has been put together as a support mechanism for virtual teams. Working on a team, in a face to face environment, toward a common goal can be a rewarding and positive experience.

Benefits of working collaborationly:

- Sharing of skills and resources
- Increases creative thinking
- Development of a shared understanding of issues or problem
- Learning to problem solve and work with others
- Preparation for the work place

It can also prove to be extremely difficult. Now, add the component of working on a team in a virtual setting and these problems can seem to be more of a roadblock to success.

Some of the problems which may occur include:

- Lack of trust among team members
- Poor cohesiveness
- Potential drawbacks to electronic communication such as process losses

If team members do establish trust with each other it is possible that they will have an increased sense of ownership of the project and that they will more readily validate other team member's work. Group cohesiveness can enhance the motivation of group members and open lines of communication between group members. Process losses occur when specific issues arise which take away from the group's ability to solve problems and

progress. An example of this type of problem is when one team member is not actively involved.

In order to reduce some of these issue the group training program provides information toward establishing relationships between group members and providing information on how to provide structure to the process of creating a group deliverable.

The training program has been created as a series of modules. These modules are meant to be completed in order.

Module list and brief description:

1. **Module 1- Orientation and Trust Building**
    1. Establishing relationships between group members and deciding on how the group will communicate.
    2. Activity: D2L survey
2. **Module 2- Task Diagnosis Process**
    1. Process for determining a better understanding of the different requirements and tasks involved for the team to successfully complete each required deliverable.
    2. Activity: Word document assignment which can be found in the dropbox
3. **Module 3- Activity Decomposition**
    1. Process for further breaking down each task into activities
    2. Activity: D2L Survey
4. **Module 4- Applying Patterns to Activities**
    1. Each activity has a specific pattern of collaboration, such as creating ideas, in this module specific tools and suggestions are given on how to best proceed.
    2. Activity: D2L Survey
5. **Module 5- Agenda Building**
    1. In order for a group to be successful, a team agenda needs to be developed. The agenda building module discusses some of the requirements.
    2. Activity: D2L Survey
6. **Module 6- Design Validation**
    1. The design validation module stresses the importance of checking the organization or process the group has set up.
    2. Activity: D2L Survey

The training program itself is set up in a specific order, but when using this information in an actual group it is possible to use the techniques discussed at several different points throughout the process.

You will not be graded on the activities of these modules except to receive credit for completing them. For example, when you take a survey I will not assign a grade value to your answers, but instead give you points for completing the activity. There is 1 activity for each module; if you complete all 6 activities you will receive 30 points.

Module 1- Orientation and Trust Building

Saturday, November 21, 2009

8:04 AM

The first two aspects of working in a group that we are going to discuss is orientation and trust building within a group. Within this phase it is important to establish relationships between group members and to form communication norms within the group. The development of communication norms involves group members decided on the best means of communicating with each other. This phase is important because if group members have a feeling of trust and understanding of how to communicate with the group they can better establish a feeling of ownership of the group.

Step 1: Orientation- in this step team members need to answer the question, "Why am I here?"

- The following issues should be resolved in this step:
  - Purpose- does everyone in the group have a common understanding of why they are here?
  - Personal Fit - how does each team member contribute to the group
  - Membership- feelings of ownership of group purpose

Step 2: Trust building- in this step team members need to answer the question, "Who are you?"

- The following issues should be resolved in this step:
  - Mutual regard- respect for teammates
  - Forthrightness- honesty
  - Spontaneous interaction- feeling comfortable with communication between team members

Establish:

- Mutual regard
- Forthrightness
- Spontaneous Interaction

Establish:

- Purpose
- Personal fit
- Membership

Module 1- Orientation and Trust building activities

Saturday, November 21, 2009

9:04 AM

- Activities to accomplish Orientation and Trust building goals:
    - Ice breaker activity- during this activity all team members should introduce themselves and spend some time getting to know one another. You can exchange information such as names, interests and background information.
        - Example:
            - Good Things come in three's
                - Tool: Discussion board or email
                - Configuration: One student begins the process
                - Script:

                    Introduce yourself by listing your name, major, home town etc.

                    Include the three following pieces of information:

                    List your three favorite websites.

                    List your three favorite activities.

                    List your three favorite people.

    Group formation activity- team members should be aware of potential problems which can occur when communicating electronically, such as team members who do not participate.

    Ideas for encouraging participation:

    You can try sending personal invitations to other team members through email, chat or Skype. If a team member is only contacted through one of these mediums, it may not be a medium that they actively use. The use of multiple types of mediums may reach them sooner.

    Providing positive and timely feedback to team members can also improve their feelings of ownership of the group project.

    The use of electronic mediums which will allow team members to view their participation can also help encourage all team members.

    Encouraging teammates and being enthusiastic about a project or a task can help engage team members.

This topic has been mentioned before, it is extremely important to make sure and establish open lines of communication early in the process. This means finding the best tool for communication. All team members need to decide which tool they will actively use. For example, does the group want to use DSU mail or D2L mail? Which one do the team members check more often? How often are you online? How quickly do you normally respond to messages.

Have you heard of the *Rules of Netiquette*? These rules are simple guidelines on how to communicate in a online environment.

Remember the Human- remember that there is a person with feelings on the other end of your computer screen. It is easy to misinterpret meanings.

Adhere to the same standards of behavior online that you follow in real life- if you run into an ethical dilemma in cyberspace, follow the same code you follow in real life.

Know where you are in cyberspace- get a sense of your surroundings and those in these surroundings in order to develop an understanding of acceptable behavior.

Respect other people' time- be thoughtful and timely when responding to others, include descriptive titles in emails, discussion forums etc.

Make yourself look good online- be aware of your grammar and spelling, make thoughtful contributions and be polite.

Share expert knowledge- don't be afraid to share what you know.

Help keep flame wars under control- flaming is when someone expresses their opinion in a strong and emotional manner. A flame war occurs when two members in a group have a series of conversations that dominate the discussion and destroy the group.

Be forgiving of other people's mistakes-when someone makes a mistake, be kind about it.

Module 1- D2L Activity

Saturday, November 21, 2009

9:49 AM

In Desire 2 Learn you will find a survey which will ask you some questions with regard to the Orientation and Trust building information we have just discussed. This survey is meant to evaluate your understanding of the information.

- Due date:
- You will not receive a grade for this item such as A, B etc. You will receive a participatory grade only.
- Please feel free to use your notes and any resources, but I would like for you to work individually.

Module 2- Structuring Group Activities

Saturday, November 21, 2009

9:53 AM

The next module we will be discussing deals with the group development task of determining the requirements of the group and the group project. Upon conclusion of this process the group should have an outline of the requirements, deliverables and responsibilities necessary to complete the project. There are three steps in the Structuring of Group Activities module.

Step 1: Task Analysis- the goal of this step is so determine all of the goals, objectives and deliverables for the project.

1. What are the goals and objectives of the project?
    1. Example 1: To gain a shared understanding of the material
    2. Example 2: To gain a shared awareness of the material

2. What are the deliverables?
    1. What are the different activities or tasks which need to occur in order to complete each deliverable?

Step 2: Group Member Analysis- the goal of this step is to determine the strengths of each team member and have a common understanding of the roles each group member should take.

1. In this step it is important to determine individual group member:
    1. Motivation
    2. Expertise
    3. Commitment

Step 3: Resource Analysis- the goal of this step is to determine the project timeline, all available resources and any available technology tools which can be utilized.

One of the key aspects of this process is to first determine the deliverables and the tasks or the activities that need to be taken in order to effectively result in the completion of each deliverable. Each group member should also have a level of responsibility for each activity determined by their role or their strengths.

Module 2- Structuring Group Activities Sample Problem

Sunday, November 22, 2009

1:59 PM

THE PARKING PROBLEM

You have probably tried to find a place to park around campus and know that it is not always easy. Even if you don't have a car on campus, you probably have witnessed such problems. This is especially true when you are late for class, an appointment or a ball game.

The question put forth to you today is: What can be done to help reduce the parking problem?

Be specific, complete and concise - yet you need to provide enough information so that someone else

can fully understand your idea without requiring further explanation.

Step 1: Task Analysis-

What are the goals and objectives of this project?

1. To learn how to work together as a group to solve a problem
2. To develop an understanding of the parking problem
3. To develop a plan to reduce the parking problem
4. More ??????

What are the deliverables?

1. A complete list of viable action items, and their descriptions, which can be used to reduce the parking problem.
2. More???????
3. Tasks:
    a. Interview relevant persons
    b. Research problem
    c. Brainstorm on ideas
    d. Organize and clarify ideas as group

e. Put the ideas together and finalize

Step 2: Group Member analysis- due to this exercise it is difficult to determine the group member analysis, so this part is a fictitious example of the process

1. Determine the strengths of the group members.
    a. Does anyone have experience working in the physical plant with the parking crew?
    b. Does anyone feel comfortable interviewing the necessary individuals in order to gain a better understanding of the current situation?
    c. What experience(s) do the group members have with this type of a problem?
    d. How committed are the group members to solving this problem?

Step 3: Resource Analysis-

1. What are the timelines or due dates for the various aspects of the deliverable? Should their be more?
2. How is the group going to come to a consensus on the information required? Vote?
3. What tools are the group going to have access to? A discussion form? A place to store documents?

Module 2 Activity

Monday, April 19, 2010

10:29 AM

In D2L you will find a drop box with instructions for completing the activity for Module 2.

- Due date:
- You will not receive a grade for this item such as A, B etc. You will receive a participatory grade only.
- Please feel free to use your notes and any resources, but I would like for you to work individually.

Module 3- Activity Decomposition

Sunday, November 22, 2009

4:01 PM

The Activity Decomposition module discusses the process for further developing the tasks or activities required to complete each deliverable. In the previous module, a basic list of activities were created. In this module various techniques will be used to further determine how to reach a consensus on each step or come to a conclusion on each activity.

In order to determine how to further analyze each task it is important to think about what type of collaboration will be used during the process. There are five common patterns of collaboration which can occur throughout the process.

The five patterns include:

1. Generate- this pattern of collaboration is used when a group would like to move from having fewer ideas to having a larger number of ideas to choose from. Brainstorming would be an example of using

2. Reduce- use this pattern of collaboration when you want to move from having many ideas to focusing on a few different ideas.

3. Organize- this pattern can be used to develop relationships among the different ideas and establish a structure.

4. Evaluate- this pattern can be used to determine the value of an idea or a concept within a group or a deliverable. An example of this type of pattern is when a group votes on the final number of ideas to include in a project.

5. Build Consensus- this pattern can be used when looking to gain a commitment from all group members.

The primary goal of this process is to answer the following questions:

1. How can we break this process up into smaller segments or activities?

2. What activities will help us achieve our goals?

3. What general pattern does each of these activities belong to?

When applying this process to a groups tasks or deliverables it helps the group have a better understanding of how to further develop each task. To complete this phase it is important to match the tasks or the activities that the group has listed, with each pattern of collaboration. It is possible that each task has multiple patterns of collaboration.

One thing that needs to be kept in mind is that this is a collaboration effort between you and your team members. If each team member decides on all aspects of the task they are responsible for, technically the project is not collaboration. Team members should have some input into the progress of each task.

Module 3- Activity Decomposition Sample Activity

Sunday, November 22, 2009

4:51 PM

In order to show how the Activity Decomposition process can occur, the parking problem example will be reused.

The problem:

What can be done to help reduce the parking problem?

Be specific, complete and concise - yet you need to provide enough information so that someone else can fully understand your idea without requiring further explanation.

Task list from module 2- Structuring Group Activities:

1. Interview relevant persons
2. Research problem
3. Brainstorm on ideas
4. Organize and clarify ideas as group
5. Put the ideas together and finalize
6. Complete parking problem recommendation document

Activity Decomposition for each task:

1. Interview relevant persons
    i. Generate interview questions
    ii. Reduce and organize interview question
2. Research problem
    i. Generate topics to research
    ii. Evaluate information
3. Interview relevant persons
    i. Evaluate interview results
4. Develop on ideas
    i. Generate or brainstorm on possible parking problem solutions

   ii. Reduce the number of ideas to a legitimate few
5. Organize and clarify ideas as group
   i. Organize ideas, for example if a few of the ideas are solutions which effect students and a few of the ideas are solutions which effect faculty these are two different categories which should be listed.
   ii. Evaluate ideas, are the solutions complete? Are they valuable ideas?
6. Put the ideas together and finalize
   i. Build consensus, make sure that all group members are in agreement on the final list of recommendations from the group. If they are not, it may be necessary to evaluate each item again.
7. Complete parking problem recommendation document
   i. Build consensus, again, it is necessary to make sure that all team members support the information and the set-up of the final deliverable.

Module 4- Applying Repeatable Techniques to Activities

Sunday, November 22, 2009

7:02 PM

In order to complete the tasks which have been developed in the previous modules a repeatable technique can be used. These techniques are based on the five patterns of collaboration. Each technique itself can be repeated through the process of completing tasks. These techniques can provide guidelines and prompts for the group on how to proceed within each pattern of collaboration. Each technique will have a name, a specific pattern of collaboration which it belongs to, a suggested tool which can be used to facilitate it, specific information on how to set up the tool and finally a short script which will give the users a specific set of instructions on how to use the tool once it has been set up.

Each technique contains:

1. Name
2. Additional guidelines for use
3. Description
4. Tool (recommendations for tools which may be used)
5. Tool setup
6. Script

In this module we will discuss two different techniques for each pattern of collaboration. The patterns of collaboration are:

1. Generate
2. Reduce
3. Organize
4. Evaluate
5. Build Consensus

At the completion of this module you should have an understanding of how each technique can be used, how it should be used and how to apply it to specific activities. Each technique will need one person, or a moderator, to be responsible for setting it up, managing it and finishing it. This person can be the group leader or the person responsible for the task itself.

Generate Repeatable Techniques

Monday, November 23, 2009

10:26 AM

The first pattern of collaboration we are going to discuss is Generate. This pattern of collaboration is used when a group would like to move from having fewer ideas to having a larger number of ideas to choose from. The two examples below discuss repeatable techniques which can be used to generate ideas. These techniques can be used at any time during the development of project deliverables. They can also be used multiple times.

Technique #1:

- **Name**: LeafHopper
- **Additional guidelines for use**:
  - Use this technique:
    - When you want to brainstorm on several ideas at once
    - When different participants will have different levels of expertise
    - When it is not important to assure that every participant contributes to every topic
- **Description**: Team members start with an electronic list of several discussion topics in one location. Each team member hops among the topics to contribute.
- **Tool** (recommendations for tools which may be used):
  - Discussion Forum
  - Additional suggestions:
    - Wridea (http://wridea.com/)
    - Wiki (https://my.pbworks.com/)
    - Google Docs
    - Online sticky notes (http://www.stixy.com/)
- **Tool setup**:
  - Create a new topic, or location to make comments, for each brainstorming topic
- **Script:**
  1. Briefly explain to the group how to find the location to brainstorm.

2. Explain each of the topics to the group and verify that the participants understand them.
3. Explain the kinds of ideas that the group should contribute.
4. Explain to team members that they should start working on the topics they have the most expertise and if they have time, move to each of the other topics to read and comment on the contributions of others. There may not be enough time to work on every topic.
5. Make sure to place some type of a due date with the session so that team members know time limits.

Technique #2:

- **Name**: OnePage

- **Additional guidelines for use**:
  - To generate a few comments or ideas on one topic.
  - When 5 or fewer people will be brainstorming together.

- **Description**: Team members start with a single page in which to contribute brainstorming ideas to. All ideas should be restricted to a single page. The comments can be made synchronously or asynchronously.

- **Tool** (recommendations for tools which may be used):
  - Discussion Forum
  - Chat room - resulting script from brainstorming session should be saved by one group member.
  - Additional suggestions:
    - Wridea (http://wridea.com/)
    - Wiki (https://my.pbworks.com/)
    - Google Docs
    - Online sticky notes (http://www.stixy.com/)
    - Try finding your own at: Go 2 Web 2.0 (http://www.go2web20.net/)

- **Tool setup**: create a new topic, or chat room to make comments, for single brainstorming topic

- **Script**:
  1. Briefly explain to the group how to find the brainstorming session.
  2. Make sure that participants understand the question or topic to be discussed.

3. Participants should contribute as many ideas as they can come up with in the allotted time.
4. Make sure to place some type of a due date with the session so that team members know time limits. The time limits for this technique should be relatively short.

Reduce Repeatable Techniques

Monday, November 23, 2009

10:26 AM

The second pattern of collaboration we are going to discuss is Reduce. This pattern of collaboration is used when a group when you want to move from having many ideas to focusing on a few different ideas. The two examples below discuss repeatable techniques which can be used to reduce the number of ideas.

Technique #1:

- **Name**: OneUp
- **Additional guidelines for use**:
  - To reduce a number of high quality ideas under time pressure
  - To create criteria for judging the quality of the ideas
  - It is possible that this technique can be used it the problem is not well understood
- **Description**: This technique looks to have the group focus on the best ideas from a brainstorming session and develop criteria for evaluating them. This causes team members to identify high quality ideas and at the same time explain why they are the best ideas.
- **Tool** (recommendations for tools which may be used):
  - Discussion forum
  - Email
  - Word document > emailed to individuals
  - Additional suggestions:
    - Wridea (http://wridea.com/)
    - Wiki (https://my.pbworks.com/)
    - Google Docs
    - Online sticky notes (http://www.stixy.com/)
- **Tool setup**:
  - Briefly explain to the group how to find the brainstorming comments to be reduced as well as how to find and use the tool which they can use to

submit their suggestions.

- **Script**:
  1. Ask participants to review the brainstorming comments
  2. Participants should then pick the most important item or the best idea and an argument as to why it is the best idea.
  3. When using a discussion forum or email, the next contribution by a team member should either agree with the previous suggestion or offer a new suggestion and an argument as to why that suggestion may be better from the previous one.
  4. The moderator should also contribute to the discussion and organize the results from the session. Once the results have been organized, they should be shared with the group.

Technique #2:

- **Name**: ReviewReflect

- **Additional guidelines for use**:
  - Use this technique when a group must review, validate and modify the content of an existing outline or other information structure.

- **Description**: This technique allows team members to adapt an existing generic text to the needs of the task at hand, or to review and comment on a deliverable document. The technique has two phases. In the first phase, all team members review and comment on existing content. In the second pass, the participants negotiate the re- structuring and re-wording of the content.

- **Tool** (recommendations for tools which may be used):
  - Any document sharing tool, document itself can be posted in a central location or posted to a tool such as Google Docs, where team members can all contribute to the same document.
  - Initial document should also have the ability to be marked up

- **Tool setup**:
  - Document should be posted in a readily available location.

- **Script**:
  1. Briefly explain to the group how to find the initial document to be discussed.
  2. The moderator for this technique is extremely important. They are responsible for each step in the script.

3. The document to be edited should be posted.
4. Explain to team members that they should open the outline or the document and make suggests to the document such as:
    a. Removing content
    b. Rewording content
    c. Adding content
5. Moderator should adjust document based on comments and post for further discussion. Process is completed when all team members agree on document content.

Organize Repeatable Techniques

Monday, November 23, 2009

10:26 AM

The third pattern of collaboration we are going to discuss is Organize. This pattern of collaboration is used to develop relationships among the different ideas and establish a structure. The two examples below discuss repeatable techniques which can be used to organize ideas.

Technique #1:

- **Name**: RichRelations
- **Additional guidelines for use**:
  - To create a set of categories for organizing brainstorming comments
- **Description**: In this technique participants review brainstorming comments or suggestion and try to find at least two items that are related in some way. They then describe the relationships. That relationship becomes the name of a category.
- **Tool** (recommendations for tools which may be used):
  - Discussion forum
  - Online document creation tool
- **Tool setup**:
  - New forum topic is created for team member comments
- **Script**:
  1. Briefly explain to the group how to find the initial document to be discussed. Document should be posted in a readily available location.
  2. Explain to team members that they should read through the brainstorming comments or suggestions previously created.
  3. If they find two or more comments that are related in some way, they should explain this relationship.
  4. Participants should continue examining comments or suggestions until they can find no more relationships.

5. Participant comments should be combined into one document.

Technique #2:

- **Name**: ExpertsChoice

- **Additional guidelines for use**:
  - Use when a group does not have enough time to organize a set of ideas together.
  - Use when a group feels unqualified to organize a set of ideas into categories.

- **Description**: The ExpertsChoice technique can be used when the group does not have enough time to organize ideas or does not feel qualified to do so. They may choose an expert amongst their group or in some situations someone outside their group.

- **Tool** (recommendations for tools which may be used):
  - Discussion forum
  - Document sharing tool

- **Tool setup**:
  - Results from brainstorming session should be organized into one location.
  - A new forum or tool should be created to contain the results of the expert review.

- **Script**:
  - Briefly explain to the group how to find the initial information or tool.
  - Team members should agree on a expert to organize ideas.
  - Expert should receive ideas and is then free to define categories and relationships to them.
  - Expert should re-organize ideas based on categories, briefly explain categorization or any difficulties which occurred and post them for review. Difficulties can be ideas that were unclear or ideas which could fit into more than one category.
  - Team members agree with categorization or offer suggestions

Evaluate Repeatable Techniques

Monday, November 23, 2009

10:26 AM

The fourth pattern of collaboration we are going to discuss is Evaluate. This pattern of collaboration is used to develop relationships among the different ideas and establish a structure. The two examples below discuss repeatable techniques which can be used to evaluate ideas.

Technique #1:

- **Name**: StrawPoll
- **Additional guidelines for use**:
  - To measure consensus within a group
  - To reveal patterns of agreement of disagreement within a group
  - To assess or evaluate a set of concepts
- **Description**: The StrawPoll technique enables the temperature of the group to be measured. It quickly finds out which preferences the group has and what the level of consensus is among group members.
- **Tool** (recommendations for tools which may be used):
  - Email
  - Discussion board
- **Tool setup**:
  - Post a set of issues to be voted on
  - Establish the voting criteria
- **Script**:
  - Briefly explain to the group how to find the initial information or tool.
  - Explain to team members that they are going to vote on several items, but the decision is not final at the conclusion of the vote.
  - Explain to team members how the vote is set up and how the voting criteria is set up. For example, "Please rate each item on a scale from 1 to 10. A rating of 1 means…. a rating of 10 means…..

- Final results can then be published and discussed. Moderator can keep results anonymous.

Technique #2:

- **Name**: BucketShuffle

- **Additional guidelines for use**:
  - Use this technique to put the ideas within a category into some sort of order

- **Description**: This technique allows groups to prioritize a set of concepts that have already been organized in categories. Team members review the content of each category and discuss the priority level of each item.

- **Tool** (recommendations for tools which may be used):
  - Discussion board
  - Email

- **Tool setu**p:
  - Brainstorming ideas and categories should be summarized and readily available.
  - A new forum or a new email should be created and accessible to team members.

- **Script**:
  - Briefly explain to the group how to find the initial information or tool.
  - Explain to team members that they should order the items in a category by level of importance or priority.
  - Process should be repeated for each category.
  - Moderator organizes and publishes results.

Build Consensus Repeatable Techniques

Monday, November 23, 2009

10:26 AM

The fifth and final pattern of collaboration we are going to discuss is Build Consensus. This pattern of collaboration is used when looking to gain a commitment from all group members. The two examples below discuss repeatable techniques which can be used to build consensus.

Technique #1:

- **Name**: SevenUp
- **Additional guidelines for use:**
  - When a group would like to come to a consensus on the best ideas from a brainstorming session.
- **Description**: In this technique there are two polling or voting activities geared toward selecting the best concepts or topics in a brainstorming session. In the first activity all members and rate each idea on a scale from 1 - 10. All ideas that get a rating of 5 or above are then voted on again until they are narrowed down to the appropriate number of items.
- **Tool** (recommendations for tools which may be used):
  - Discussion forum
- **Tool setup**:
  - Create a new forum based on the comments from a brainstorming activity. All activities to be voted on should be included.
  - After the first vote, a new topic should be created for all comments receiving a 5 or above.
- **Script:**
  - Briefly explain to the group how to find the initial information or tool.
  - Explain to group members that they will first be rating each of the comments from the initial brainstorming activity on a scale from 1 - 10. All items about 5 will be gathered.

- Group members can again vote on these items until they are narrowed down to the appropriate number.

Technique #2:

- **Name**: PointCounterPoint

- **Additional guidelines for use**:
  - To find common ground
  - Do not use to force consensus on an issue. This technique is meant to discover new lines of though to help solve a disagreement.

- **Description**: Team members are involved in a three-step activity where they enter their strongest argument in favor or their position, argue against someone else's position and build an argument to bridge two seemingly mutually exclusive positions taken by others in the group.

- **Tool** (recommendations for tools which may be used):
  - Discussion board

- **Tool setup**:
  - A separate forum should be created for each topic that needs to be further discussed.

- **Script**:
  - Each team member should post their position on the topic and their argument for it.
  - After the initial posting, all team members should post at least one counter-argument against a position.
  - Once the counter-arguments have been posted, all team members should examine the arguments for and against a topic.
  - The moderator should begin a discussion toward resolving the issue.

Repeatable Techniques Sample Activity

Monday, November 23, 2009

10:41 AM

In order to show how the Activity Decomposition process can occur, the parking problem example will be reused.

The problem:

What can be done to help reduce the parking problem?

Be specific, complete and concise - yet you need to provide enough information so that someone else can fully understand your idea without requiring further explanation.

Task list from module 2- Structuring Group Activities:

1. Interview relevant persons
2. Research problem
3. Brainstorm on ideas
4. Organize and clarify ideas as group
5. Put the ideas together and finalize
6. Complete parking problem recommendation document

Activity Decomposition for each task:

1. Interview relevant persons
    i. Generate interview questions
    ii. Reduce and organize interview question
2. Research problem
    i. Generate topics to research
    ii. Evaluate information
3. Interview relevant persons
    i. Evaluate interview results
4. Develop on ideas
    i. Generate or brainstorm on possible parking problem solutions

ii. Reduce the number of ideas to a legitimate few

5. Organize and clarify ideas as group
   i. Organize ideas, for example if a few of the ideas are solutions which effect students and a few of the ideas are solutions which effect faculty these are two different categories which should be listed.
   ii. Evaluate ideas, are the solutions complete? Are they valuable ideas?
6. Put the ideas together and finalize
   i. Build consensus, make sure that all group members are in agreement on the final list of recommendations from the group. If they are not, it may be necessary to evaluate each item again.
7. Complete parking problem recommendation document
   i. Build consensus, again, it is necessary to make sure that all team members support the information and the set-up of the final deliverable.

Repeatable Technique Application

i. Interview relevant persons
   1. Generate interview questions (LeafHopper)
   2. Reduce and organize interview questions (RichRelations)

ii. Research problem
   1. Generate topics to research (LeafHopper)
   2. Evaluate information (OneUp)

iii. Interview relevant persons
   1. Evaluate interview results (ReviewReflect)

iv. Develop on ideas
   1. Generate or brainstorm on possible parking problem solutions (LeafHopper)
   2. Reduce the number of ideas to a legitimate few (RichRelations)

v. Organize and clarify ideas as group
   1. Organize ideas, for example if a few of the ideas are solutions which effect students and a few of the ideas are solutions which effect faculty these are two different categories which should be listed.
   2. Evaluate ideas, are the solutions complete? Are they valuable ideas? (RichRelations)

vi. Put the ideas together and finalize
   1. Build consensus, make sure that all group members are in agreement on the final list of recommendations from the group. If they are not, it may be necessary to evaluate each item again. (SevenUp)

vii. Complete parking problem recommendation document
   1. Build consensus, again, it is necessary to make sure that all team members support the information and the set-up of the final deliverable. (SevenUp)

Module 5- Agenda Building

Tuesday, November 24, 2009

12:43 PM

The fifth module that we will be discussing is called Agenda Building. This module will discuss the process of building an agenda for your group. Building an agenda for your group is important because it outlines the sequence of events for the completion of the group activity. It is a document that will potentially change throughout the course of your group work and adjusted based on the direction of the group. The agenda should include all of the relevant information pertaining to tasks, deliverables, patterns of collaboration, assignment and time or due date.

The agenda format should be similar to the following table:

Task/Activity	Description	Collaboration Pattern	Responsibility	Deliverable	Time
1.					
2					
Etc.					

1. Task/Activity: These are the tasks which resulted from the module 2, Structuring Group Activities and module 3, Activity Decomposition.
2. Description: A brief description of the task or activity.
3. Collaboration Pattern(s): List of the collaboration patterns and repeatable techniques to be used for the task.
4. Responsibility: Person who is responsible for task completion.
5. Deliverable: Specification of the expected output.
6. Time: Estimated time needed for the activity or the due date.

Sample Agenda

Tuesday, November 24, 2009

12:53 PM

The following agenda is a sample agenda based on the parking problem activity we have been working through in each of the modules.

Task/Activity	Description	Collaboration Pattern	Responsibility	Deliverable	Time
1. Interview relevant persons	In order to understand the parking problem on campus it is important to understand the rational behind why people have made specific decisions.	1. Generate interview questions (LeafHopper) 2. Reduce and organize interview questions (RichRelations) 3. Evaluate interview results (ReviewReflect)	Team member 1	Interview transcript, to be used during solution brainstorming session.	Week 1
2. Research problem	Specific research on the parking problem such as what kind of a parking problem, what has caused the parking problem, how people feel about the	1. Generate topics to research (LeafHopper) 2. Evaluate information (OneUp)	Team member 2	Research summary, to be used during solution brainstorming session	Week 1

	problem need to be understood.				
3. Brainstorm on ideas for parking problems solutions	After completion of the interview and the research process it is time for all group members to come up with several ideas for solutions.	1. Generate or brainstorm on possible parking problem solutions (LeafHopper) 2. Reduce the number of ideas to a legitimate few (RichRelations)	Team member 3	Brainstorming ideas	Week 2
4. Organize and clarify ideas as group	Once a number of ideas have been developed they may need to be reduced, organized or clarified so that each group member agrees with the results.	1. Organize ideas, for example if a few of the ideas are solutions which effect students and a few of the ideas are solutions which effect faculty these are two different categories which should be listed. 2. Evaluate ideas, are the solutions complete? Are they valuable ideas? (RichRelations)	Team member 3	Draft of Parking Problem Solution document	Week 2
5. Put the ideas together and finalize	Once a consensus has been reached the Parking	1. Build consensus, make sure that all group members are in agreement on the final list of recommendations	Team member 3	Final draft of Parking Problem Solution	Week 3

	Problem Solution document can be finalized.	from the group. If they are not, it may be necessary to evaluate each item again. (SevenUp)			
6. Complete parking problem recommendation document	One team member should be responsible for finalizing and submitting document.	1. Build consensus, again, it is necessary to make sure that all team members support the information and the set-up of the final deliverable. (SevenUp)	Team member 2	Parking Problem Solution document	Week 3

Module 6- Design Validation

Tuesday, November 24, 2009

1:07 PM

The last module we will be discussing in the group training module is Design Validation. The last step toward completion of the collaboration plan is to evaluate the plan itself. The evaluation of a plan can be used to prevent information from being forgotten as well as to make sure that the plan can be completed. The main way to evaluate a design is to walk-through each step as a group. Each member can evaluate the activities and the tasks and offer suggestions for improvements. One of the repeatable techniques can be used for this as well.

So, looking back what is the goal of the group training exercises? The goal is to help groups work together effectively toward completing their goals (which is completion of the deliverables). The training program offers processes and techniques toward accomplishing this goal in order to minimize many of the problems groups run into.

When working in a group you can use these modules as a guide toward organizing your group. At the completion of the last module each team member has an understanding of their role and responsibility within the group and they can each begin working on their assigned tasks. It is important to remember that this design or outline can be changed at any time depending on the needs of the group.

Appendix B: Team Survey instrument (Pilot Study)

Take Survey - ARTD-245-D31-2009FA
History of Graphics-Dittman - South Dakota Board of Regents Page 1 of

PURPOSE

The purpose of this survey is to gather information regarding the virtual team of which you were a member. It is important for me to understand how virtual team members think and feel in order to provide a positive learning experience.

YOUR PARTICIPATION

Your participation in this survey is anonymous and completely voluntary. Whether you choose to participate in the survey or choose not to participate, your grade in this course will not be affected. You can stop your survey and withdraw from participation at any time without any penalty or consequence. If you withdraw, your grade will not be affected. Responses from all completed surveys will be pooled together.

DIRECTIONS

The virtual team survey will take approximately 10-15 minutes to complete. Please follow the instructions on the survey itself and indicate your response accordingly.

Question 1

Please answer each of the following questions based on your group experience for Project 1. Your answers will not determine a grade, but help to determine the tools and methods used by your group to better understand the group process. Each question is set up to be answered using a agreement scale.

#		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I received sufficient information to understand the team's purpose when I was notified about being a member of this team.					
2	I was able to add value to the teams work.					
3	During the team's first meeting of discussion some time was dedicated to team building exercises such as meeting individual team members, creating effective team communication, and/or discussing conflict resolution.					
4	I relied on other team members to complete my assigned work.					
5	Team members trusted one another and would consult each other if they need support.					
6	Team members experience a sense of shared goals and objectives.					

7	Our team was a very cohesive unit.					
8	When disagreements occurred, they were usually addressed promptly in order to solve them.					
9	Time was dedicated to develop social relations as well as addressing tasks issues during the course of the project.					
10	Team members regularly used electronic communication to share ideas.					
11	Team members used their own judgment in solving problems.					
12	A team leader was established early in group formation process.					
13	I had access to all of the information I needed to perform my tasks.					
14	The team was equipped with adequate tools and technologies to perform our tasks.					
15	Team members were in contact with one another on a regular basis to conduct work.					
16	Team members were in contact with one another on a regular basis for social, or non-business purposes.					
17	The electronic methods we used to communicate with one another were effective.					
18	There was respect for individuals in the team.					
19	I feel my input was valued by the members of the team.					
20	During the team's first meeting or discussion, some time was dedicated to discussing the team's purpose and goals.					
21	The goals, objectives and deliverables were developed by the team.					
22	Team members were able to recognize our collective talents and utilize them from the beginning.					
23	Team members had a shared understanding of the team goals and requirements					
24	In the initial phase of the project, the team collaboratively decided on the activities needed to meet the requirements and achieve the goals/deliverables of the project.					
25	In the initial phase of the project, the team collaboratively decided on the sequence and/or structure between the activities needed to meet the requirements and achieve the goals/deliverables of the project.					
26	At some point during the project, specific activities were defined for each deliverable through a collaborative team effort.					
27	At some point during the project, a project agenda, specifying deliverables, associated activities, and timeline was developed through a collaborative team effort.					
28	All team members provided input on developing the project agenda.					

Save Submit

Appendix C: Training Feasibility Test Survey (Pilot Study)

Question 1

Did you recieve sufficient information before the training?

- Yes
- No

Question 2

How do you rate the usefullness of the following parts of the training? (1- Not at all useful, 3 - neutral, 5- very useful)

#		1	2	3	4	5
1	Explanation of patterns of collaboration (diverge, converge, organize, evaluation, and build consensus) and repeatable technique structure (description, tool, script).					
2	Exercises and explanation of the group organization technique covered in each module.					
3	Repeatable technique explanation and activities.					
4	General do's and don'ts and guidelines for working collaboratively.					

Question 3

How do you rate the usefullness of the following training materials? (1- Not at all useful, 3 - neutral, 5- very useful)

#		1	2	3	4	5
1	Lecture videos					
2	OneNote and PDF files					
3	Sample activities and exercises					

Question 4

Were the training materials complete?

- Yes
- No

Question 5

Are there elements in the training materials that you think are unnecessary? If your answer is no, please skip this question and proceed to the next one.

Question 6

Please state your opinion with regard to the following statements. (1-very much disagree, 3- neutral, 5-very much agree)

#		1	2	3	4	5
1	I will use the group training techniques.	○	○	○	○	○
2	The group training techniques are useful for me.	○	○	○	○	○
3	After the training, I felt better equipped to work in a group and accomplish the group task.	○	○	○	○	○

Question 7

Please state your opinion with regard to the following statements. (1-very much disagree, 3- neutral, 5-very much agree)

#		1	2	3	4	5
1	The training materials were well introduced and explained.	○	○	○	○	○
2	The training material was presented in a logical order.	○	○	○	○	○
3	I found that the training required a lot of mental effort.	○	○	○	○	○
4	I found the training difficult.	○	○	○	○	○
5	I found the training tiring.	○	○	○	○	○

Question 8

Was the training too long or too short?

- ○ Too long
- ○ Too short
- ○ Just right

Question 9

Additional comments?

Save

Appendix D: Team Survey Instrument (Extended Study)

PURPOSE

The purpose of this survey is to gather information any group project of which you recently completed. When you are taking the survey you should answer the questions based on your last experience with a group project or with your general experience with group projects in any class.

YOUR PARTICIPATION

Your participation in this survey is anonymous and completely voluntary. Whether you choose to participate in the survey or choose not to participate, your grade in this course will not be affected. You can stop your survey and withdraw from participation at any time without any penalty or consequence. Responses from all completed surveys will be pooled together.

DIRECTIONS

The virtual team survey will take approximately 10-15 minutes to complete. Please follow the instructions on the survey itself and indicate your response accordingly.

Question 1

Gender:

- Male
- Female

Question 2

Please select your year:

- Freshman
- Sophomore
- Junior
- Senior
- Other

Question 3

Have you taken an online course before?

- Yes
- No

Question 4

If you have taken a online course(s) previously, how many group projects have you participated in during the course

(s)? If you have not taken an online course before you make leave this question blank.

- 0
- 1 - 2
- 3 - 4
- More than 4

Question 5

If you have not taken a online course previously, how many group projects have you participated in during your college career?

- 0
- 1 - 2
- 3 - 4
- More than 4

Question 6

Please answer each of the following questions based on your group experience for the most recent group project you have participated in. Your answers will not determine a grade, but help to determine the tools and methods used by your group to better understand the group process. Each question is set up to be answered using a 8 point scale. 1 - Disagree. 8 - Agree.

#		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	During the groups first meeting, or discussion, some time was dedicated to group building exercises such as meeting individual group members, creating effective group communication, and/or discussing conflict resolution.					
2	Our group established a process or a project agenda for achieving the project deliverables.					
3	Knowledge and information sharing within my group occurred easily and regularly. 					
4	Our group used a sequence or combination of collaborative activities to accomplish the project goals.					
5	I was able to contribute equally to the group's work. 					
6	Our group had to revise the process or the project agenda some time during the project.					
	During the groups first meeting, or					

7	discussion, some time was dedicated to discussing the groups goals and objectives.	○	○	○	○	○
8	Group members had a shared understanding of what the group was supposed to do.	○	○	○	○	○
9	Group members trusted one another and would consult each other if they needed support.	○	○	○	○	○
10	Our group was a very cohesive unit.	○	○	○	○	○
11	When disagreements occurred, they were usually addressed promptly in order to solve them.	○	○	○	○	○
12	Collaborative techniques, such as brainstorming or building consensus, were used for completing tasks during the project. 	○	○	○	○	○

Question 7

Please answer each of the following questions based on your group experience for the most recent group project you have participated in. Your answers will not determine a grade, but help to determine your satisfaction with the group project. Each question is set up to be answered using a 5 point Disagree - Agree scale.

#		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I had a stake in achieving the goal of the project. 	○	○	○	○	○
2	I felt satisfied with the procedures used by my group. 	○	○	○	○	○
3	When the project was over, I felt satisfied with the results.	○	○	○	○	○
4	I felt satisfied with the way in which the project was conducted. I felt good about how the project progressed.	○	○	○	○	○
5	My groups accomplishments give me a feeling of satisfaction.	○	○	○	○	○
6	I was willing to put my time and effort in the project.	○	○	○	○	○
7	I felt satisfied about the way my group carried out project activities. 	○	○	○	○	○
8	I was motivated to contribute to the project.	○	○	○	○	○
9	I liked the outcome of our group project.	○	○	○	○	○
10	The project result was not a waste of my time and effort. 	○	○	○	○	○
	What we achieved as					

11	a group met my expectations.					
12	The time and effort requested from me was reasonable.					
13	I was able to contribute relevant knowledge & experience I had.					
14	The time and effort I spend on the project was what I expected. 					
15	The result of the project had the quality I expected. 					
16	I found the project worth the time and effort. 					
17	We achieved what we intended. 					
18	The project result was as I hoped. 					
19	The input asked from me was in balance with the results. 					
20	I found the project important.					
21	What we achieved was worth the time and effort.					
22	The quality of the project results justifies my input. 					

Save

Submit

Appendix E: Group Training Evaluation Interview Questions

Student Interview Questions

Group Training Evaluation

1. Have you taken any kind of group training or had a class which discussed similar topics?

2. How useful were the different parts of the training? Please explain your answer.

3. The training materials contained lecture videos, OneNote files and sample activities. How useful did you find these? Where there any which were more useful than others?

4. Do you think that you will use any of these techniques? Please explain why or why not.

Appendix F: Group Project Evaluation Interview Questions

Student Interview Questions

Group Project Evaluation

1. Did you feel satisfied with the way that the group project progressed? Please explain your answers.

2. When the project was over, did you feel satisfied with the results?

3. Did your group use the group training techniques to complete the group project? What parts of the group training did you utilize?

4. Do you feel the group training techniques contributed to the overall outcome of the group project?

Appendix G: Interview Comments

The following comments were gathered from students during the group project and group training interview focus group and individual sessions. The comments have been organized by categories.

Comment Category	Comment
Application	I am in a group project right now in another class that I am taking. We are doing the whole agenda thing from this training program. Each week when we meet online we go through the agenda and revise it as needed so that was very valuable.
Application	I think that the only way to really get everyone to participate is to include specific requirements on their grade.
Application	For me, I felt like I already knew a lot of the information. I felt like I have done it all so many times that I do learn more. It is something I will use because it helps in the group.
Application	Right now it is really relevant to me. I am in this club where we are adding this group project and these techniques are really helping us to construct this club so that we can be organized.
Application	I will use pieces of the training program, not the entire thing. When I work in a group the most important is the agenda.
Application	I will admit that in the beginning of the group projects I have been involved in we skip the part where we get to know each other. Now that I know how important that step can be and how it is important to be comfortable with each other I will try and make sure that we do some type of activity for this.
Application	Right now I have interest in this group training and um… no matter what environment you are in it is good to develop these skills.
Application	Sometimes you get into a group and don't know what to do first. Should we just jump right in? So sometimes it feels overwhelming. If you have some standard steps and techniques to fall back on that will help.
Application	Also another thing that I thought was important was the agenda building. That is what I have struggled with in group projects in the past. Kind of trying to figure out who is doing what and when. I think agenda building is a really good thing to know what to do.
Application	I don't see groups doing a lot of those activities because they just want to get things done. They would use brainstorming, but maybe not a technique.
Application	My groups in the past have not used agendas or have maybe used pieces of it. Seeing it all organized is really helpful and I can see using it in a group project.
Application	I see it as more useful in the business world. I think students like in

	college having a group project isn't their favorite think. I think it is really beneficial because as a professional it is was your are going to be using. The struggles will be different or better in the future at a job people will be more dedicated to the project and wanting to put more of an effort.
Application	I think this is too in-depth for what we will do in a class, but definitely something we will do during our career.
Application	I can see that we would maybe use some of them, but it would be hard to incorporate them all. I think um, like I think it was the structuring and getting down the task analysis was really helpful. I am going to keep the OneNote file here for later use.
Experience Level	I took one class with Robert Jackson that was a team building class. I have also been in ROTC and that is kind of a leadership program. So I have learned how to be a team leader and how listening to others is important.
Experience Level	For me, I have never taken a group training class. I did take practical psychology which did talk about different learning styles and methods and stuff like that.
Experience Level	No, I guess I have not had any kind of group training like that before.
Experience Level	I have actually been in the workforce for a while now so I have been involved in several group training workshops. They have not focused on group projects which are done remotely or ones that are primarily online.
Experience Level	I can't say that they were the same. But probably the closest would be the team building class. We didn't talk about anything that was related to online groups.
Experience Level	No, not really. I am sure that I have talked about it in a class before but nothing really stands out to me right now.
Suggestions	I also like projects where we work on tasks based on the information that we just learned.
Suggestions	For me personally, I would like to see the training program and the group project be taught at the same time. So as we completed the modules we could then use that information and complete that task within our group project rather than doing sample activities.
Suggestions	I also agree that the group training we did should be done at the same time as the group project we did in class.
Suggestions	But I would like to see sample problems for each one (repeatable technique) showing how to use them.
Suggestions	I would recommend that you make lecture videos like this shorter than 10 minutes, especially if the material is the same material found in the OneNote file.
Suggestions	Maybe if you tell the students to either watch the video or go through the OneNote file.

Suggestions	In my opinion the technique is not as important as having a central tool that everyone uses.
Suggestions	I really do feel that in a distance group project the most important thing is to have the tools to be set up prior to the project, and that everyone has them. Having to learn a new tool is just going to make things more difficult.
Suggestions	You could use the "how to make a Peanut Butter sandwich" sample activity to make it a little easier.
Suggestions	Maybe do the group training before the group project but make some of the requirements of the group project be to use some of the techniques from the group training which will help the less experienced people.
Suggestions	I think it would be beneficial to learn these collaboration techniques during the project.
Suggestions	In order to people use it more it would need to be a requirement to get students to start using it at first.
Suggestions	It would work better to maybe do this during a group project but it would take more time. It could slow everything down so students would need more time for the project.
Suggestions	As I was going through it I was confused. I had to go through it a couple of times. Yeah, if it could be simplier that would be better.
Supplements	Um.. I found the OneNote file and the sample activities useful.
Supplements	When I started the assignment I watched the two videos but then I got kind of bored. After the first couple of videos I didn't want them. The one video was 30 minutes long and I could not sit that long. I ended up pretty much using the OneNote file.
Supplements	I have to agree that I also got bored. They were too long. I actually need to do something in order to learn it. Just by listening I got bored.
Supplements	Normally I watch lecture videos, but for this activity I found myself able to do it without the lecture videos.
Supplements	I think it is great that you give students the option to read it or watch the video.
Supplements	I didn't think they were too terribly difficult. Some of the outline in the surveys, um I don't know just trying to figure out how to apply it to the problem in the scenario. I just wasn't sure that I was applying it correctly.
Supplements	I think that it was kind of nice, just, I really liked the OneNote files and being able to see it all um you know the different steps of collaboration all laid out like that.
Supplements	I found the OneNote file and information to be the most useful.
Supplements	I watched all but one of the lecture videos and I felt they all had important information in them. The lecture videos went over the material in the OneNote and explained it in a little more detail.
Supplements	Having the videos is a nice option to have.

Supplements	The exercises were actually useful to me. The most exposure to different items the better.
Supplements	I thought they(exercises) were a little tricky, but good to get the experience and try them out. It is hard if someone says here how you do this and then you don't actually use it. It helps to put it into use right away.
Supplements	I watched the first couple of lecture videos and then as I went through them I saw that a lot of the material was in the OneNote file.
Supplements	I think it is also good to have the activities and the exercises right after the information to make it more ingrained instead of it going in one ear and out the other.
Supplements	Uh, the questions we answered after the module I didn't find to be all that helpful. I know that you want to make sure that people actually go through it. But I would have been good, just going through it on my own and maybe just having a few questions.
Supplements	really found the OneNote file useful. I primarily used that file for everything.
Usefulness	The patterns of collaboration made sense.
Usefulness	It was useful, but some of it was kind of common sense things that we should all know to do.
Usefulness	Personally, I felt that there was too much information.
Usefulness	There was a lot of information in a short amount of time that was a little hard to absorb.
Usefulness	If there was a section that didn't matter, I don't think that there is a section. It all seems cohesive and made sense to me.
Usefulness	I really found the agenda information very helpful.
Usefulness	I would actually have to do them (repeatable techniques) one by one in order to gain a better appreciation for them. There are a lot of them, and they are really good.
Usefulness	Umm.. I guess when I brainstorm I take off what is on top of my head instead of using specific techniques. The problem is always going to be that you will have one or two people in a group who just don't go online much.
Usefulness	I definitely think it(General do's & don'ts) is a great thing to have because it reminds people of what they should do, even if it is common sense. Maybe people will think twice about what they should do.
Usefulness	I agree with the dos and don'ts, it is a good reminder to people of what they should be doing.
Usefulness	But um yeah, I think it is really useful to organize your group like that. Um, but yeah I mean with some group projects you need a little more structure than with others.
Usefulness	I already knew how to use several different brainstorming techniques.
Usefulness	There was a lot of content. I didn't think that it was way too much.

	But um at the same time it was kind of a lot to do.
Usefulness	I think that(General Do's and Don'ts) was really helpful because, because that is generally a step that most groups skips or overlook is getting to know each other and getting to know the strengths and weaknesses of the individuals in a group. I think that getting to know each other in a group is something that is not usually done. There is a lot that can be learned by getting to know each other.
Usefulness	The materials overall were very good.
Usefulness	I guess what kind of stood out to me was orientation and getting to know your group members and giving everyone a chance to get to know the project and how they feel.
Usefulness	Due to having had so many experiences already with group training and having been involved in a lot of group projects over the last 10 years I am not sure that I felt a lot of the training was useful to me. Some of the online specific content might be helpful.
Usefulness	I would say it(Patterns of collaboration) is pretty useful. But like that kind of stuff like not the activities but like the generate and reduce groups would naturally do it.
Usefulness	Just the type of person that I am, I think that the agenda is a great idea.
Usefulness	There were good examples of stuff to do but with the groups being so busy they just want to get started. The general consensus is that people hate group projects so they want to get done. I did like the rules of netiquette and how to act online. That is group for just anyone even if they aren’t online. That was a really good part to learn.
Usefulness	Overall I think it (group training) is a good thing.
Usefulness	Yes and no, the certain activities I can see using. I also think it more depends on the length of the project or how big it is. Most of the time it is just a goal to get it done as quick as you can.
Usefulness	I thought that it was good, but I think in order to improve it, it should be simplified quite a bit.
Usefulness	I think the organizing task part was pretty good.