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A Study of the Success of Group Formation in Virtual Teams Using Computer-Mediated Communications

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by

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We hereby certify that this dissertation, submitted by Eliel Melon, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

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In the digital domain, virtual teams within organizations and corporations are becoming common. Restructuring an organization or corporation is vital because competition and globalization are increasing. In this era of globalization, distributed working groups need to develop a competitive advantage in these ever-changing environments. Historically, teams had experienced problems stemming from geographical and temporal limitations. With the increase of technology in telecommunications, organizations are increasingly forming virtual teams, which have become critical to the survival of nearly any corporate entity.

Virtual teams have some of the same problems that regular teams have. One of the key challenges is the method of forming teams, while such challenge is exacerbated in digital environments. Despite the difficulties, the digital environment has made successful team development all the more challenging. The variation in people's skills makes the formation of teams even more difficult. This is why organizations cannot determine in advance if a virtual team will be a success.

To evaluate the success of team formation in a virtual setting, this research study assessed the role of different computer-mediated communications (CMC) levels employed (no-CMC/face-to-face, online learning system, online learning system + social networking site) on the success of team formation measured by the level of task performance (TP), team cohesiveness (TC), computer skills (CS) and social bond (SB), while assessing the differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year. Empirical data was collected from students at the Medical Sciences Campus in the University of Puerto Rico with 140 usable records.

Using three teams and 140 participants, the results indicated that there is a statistically significance difference in the role of CMC levels employed (no-CMC/face-to-face, online learning system, online learning system + social networking site) on the level of perception of CS in team formation. Significant differences were also found in the role of CMC levels employed on the levels of TP, when controlled for gender. In addition, there is a significance difference in the role of CMC levels employed (no-CMC/face-to-face, online learning system, online learning system + social networking site) on the levels of CS, when controlled for education, academic major and academic year. The outcomes of

the study contributed to the body of knowledge for both practice and research, to help organizations identify ways to support effective team formations in virtual environments.

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Chapter 1

Introduction

Background

Individuals around the world are using social networking sites (SNS) such as Facebook® and Twitter® to interact with friends and family. Experts who responded to a survey conducted by Quitney and Rainie (2010, p. 1) about the future of the Internet said, "the use of email, social networks, and other online tools offers low-friction opportunities to create, enhance, and rediscover social ties that make a difference in people's lives". College students are heavy users of the Internet, and communication over SNS has become standard among them. The role of the Internet in the lives of individuals goes beyond being merely a method of communication; it has become an integral part of their daily lives and their social interactions (McMillan & Morrison, 2006).

Weaver and Morrison (2008) defined an SNS as a Website that "allows users to post their profiles and create personal networks for exchanging information with other users" (p. 97). The role of SNS is to enable users to articulate and make visible their social networks (Boyd & Ellison, 2007). Thus, the current study investigated the role of CMC levels employed in the success of team formation. According to Christodoulopoulos and Papanikolaou (2007a), "team formation may be used in different contexts, such as in a computer-supported collaborative learning (CSCL) context for grouping users who could potentially benefit from cooperation based on their complementariness of knowledge/skills or competitiveness, or forming groups around problems with specific requirements" (p. 57). Understanding how SNS technology can be

used to facilitate the difficult task of forming virtual teams will provide better strategies for supporting team cohesiveness and team performance (Shin & Park, 2009). Hogg and Tinsdale (2001) reported that in work groups, members' ability to get along with each other (i.e., cohesiveness) is critical to group well-being and task performance. According to Salisbury, Carte, and Chidambaram (2006), "the importance of developing such intra-team cohesiveness has proven to be particularly relevant in cases where members are not familiar with each other" (p. 148). This is also the case for virtual teams, and it appears that additional work in assessing factors and tools that can help fertilize virtual teams formation is highly needed (Malhotra, Majchrzak, & Rosen, 2007; Maynard & Mathieu, 2012).

Problem Statement

The research problem addressed was the difficulty of team formation and collaboration between individuals in virtual teams (Agustín-Blas et al., 2011; Anagnostopoulos, Becchetti, Castillo, Gionis, & Leonardi, 2012; Fransen, Kirschner, & Erkens, 2011; Liccardi et al., 2007; Malhotra, Majchrzak, & Rosen, 2007; Ounnas, 2008). According to Katzenbach and Smith (1993), the term "team" is defined as a collection of individuals who share a clear and common purpose. The attribute "virtual" designates distributed work that is predominantly based on electronic information and communication tools (Hertel, Geister, & Konradt, 2005). Hertel et al. (2005) stated:

> Virtual teams consist of two or more persons who collaborate interactively to achieve common goals, while at least one of the team members works at a

> different location, organization, or at a different time so that communication and coordination is predominantly based on electronic communication media. (p. 71)

According to Wang, Lin, and Sun (2007), team formation is a known problem. Some reasons are: members lack the requisite social skills to be in a team, while others may have problems with social loafing and time management (Wand et al., 2007). In other instances Anagnostopoulos et al. (2012) stated that "a sequence of tasks arrives in an online fashion, and each task requires a specific set of skills" (p. 839). Munkvold and Zigurs (2007) stated, “virtual teams are formed in response to specific needs and typically must perform quickly” (p. 287). Paul and Ray (2009) noted that virtual teams are comprised of individuals from different places with diverse backgrounds and, as team members do not usually meet face-to-face (F2F), they do not immediately perceive the surface-level diversity of their members. According to Baruch and Lin (2012) "virtual teams represent interdependent groups of individuals who work across space, time, and geographical boundaries with communication links that are heavily dependent upon advanced information technologies" (p. 1155). Teams need a rapid start-up and effective use of information technology (IT), and usually individuals in these virtual environments are people with no prior knowledge of the others on the team, while they need to work together immediately (Munkvold & Zigurs, 2007). Identifying the correct people to solve a business problem efficiently or collaborating effectively with others is a challenging task (Liccardi et al., 2007). It is known that establishing collaborations is a labor-intensive and risky process (Schleyer, Butler, Song, & Spallek, 2012). Teams are formed to perform a task or a series of related tasks (Guzzo & Salas, 1995). Organizations make great efforts to find ways to configure work to be done in F2F teams, while now the

formation of virtual teams addresses a new level of complexity (Fransen, Kirschner, & Erkens, 2011;London, 2001). Organizations may have team members from different cultures and time zones (Carmel & Kojola, 2012), different End-user computing (EUC) skills (Torkzadeh & Lee, 2003) and, in some instances, from other organizations. Virtual teams are a significant challenge for organizations, and the success of virtual teams is important to them (London, 2001). For the success of a virtual team, it is important that team formation will be done quickly and in a successful way, so it can effectively perform its primary task or tasks (D'Souza & Colarelli, 2010). According to Fransen et al. (2011), the success of virtual team not only depends on task characteristics and shared intentions, but also by factors, such as "team formation, team members' abilities and characteristics, role assignment within a team, decision making strategies of teams, team leadership, and interdependency" (p. 1103).

Over the past three decades, new information technologies have influenced the daily activities of people around the world. Due to the development of information communication technologies (ICT), there has been an explosion in all areas of human knowledge (Vassileva, 2008). One of those areas is the creation and use of virtual teams in organizations. Factors such as rapid globalization, technology, and a shift toward knowledge-based work environments have led to the formation of the concept of virtual teams (D'Souza & Colarelli, 2010). Virtual teams eliminate the need for physical proximity of team members (Townsend, DeMarie, & Hendrickson, 1998). Such teams are becoming increasingly popular, and it is likely that their use will continue to grow and substitute for F2F contact in some environments, including areas such as information systems development and online learning (Cascio, 1999; Hiltz & Turoff, 2005). ICTs

have evolved in response to the need to increase the efficiency and effectiveness of virtual teams (Beranek & Martz, 2005).

Tools for the improvement of virtual teams in online learning systems (OLS) have been evolving from other efforts. ICT now incorporates Wikis, blogs, virtual marketplaces, and dynamic delphi systems (Turoff, Hiltz, Yao, Li, Wang, & Cho, 2006). According to Erez, Lisak, Harush, Glikson, Nouri, and Shokef (2013), all of these are examples of collaborative methodologies for improving the ability of large groups to communicate meaningfully about complex topics. According to Francescato, Mebane, Procelli, Attanasio, and Pulino (2007), among the critical challenges faced by many organizations is the difficulty in engaging individuals "to do good teamwork, share distributed knowledge, and diminish individualism -- promoting social capital" (p. 141). It appears that social interactions via ICT can help institutions improve teamwork. Members of virtual teams can share distributed knowledge and collaborate on a problem. According to Liccardi et al. (2007), social networking tools can make the team contribute more efficiently. Pollalis and Mavrommatis (2009) stated, "the first step in directing collaborative learning environments is forming the right group(s)" (p. 627). Janssen, Erkens, Kirschner, and Kanselaar (2009) acknowledged that highly motivated groups may perform better when doing specific tasks; thus, additional investigations can add to the body of knowledge by uncovering better means of team formation in virtual teams.

According to Janssen et al. (2009), ICT has helped support the claim that collaborative activity among individuals can "effectively be supported with computer technology" (p. 161), but researchers still experience problems when individuals collaborate using ICTs. Users have problems, for example, with conflicts like task-

related, interpersonal, and process (Hobman, Bordia, Irmer, & Chang, 2002), communication difficulties (Fuks, Pimentel, & Pereira de Lucena, 2006), end-user computing skills (Torkzadeh & Lee, 2003) and shallow, noncritical discussions (Munneke, Andriessen, Kanselaar, & Kirschner, 2007). Janssen et al. (2009) stated that these problems might be due to poor implementation, while Hollingshead and McGrath (1995) stated that perhaps researchers have focused too little on potential moderators, such as team formation and composition that can influence the effectiveness of ICT. According to Joe, Tsai, Lin, and Liu (2014) considerable attention has received the concept of teams from social and organizational psychologist because "it brings important benefits for employees and their organization, such as providing and effective way of pooling creative ideas, improving interpersonal communication, enhancing team spirits, facilitating team planning, and boosting team performance" (p. 16). Few research studies have been conducted to investigate how the use of SNS can influence the success of virtual team formation. However, it appears that such research is important because the rapid combination of different individuals in a virtual team creates a challenging environment for success. Virtual team members need to overcome coordination barriers associated with working across distance and time, trust and team cohesion when they have very limited opportunities to identify common values and other challenges in the virtual work (Malhorta, Majchrzak, & Rosen, 2007). Thus, additional research is needed to investigate the success of virtual team formation.

Research Goals

The main goal of this current study was to assess the role of different CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance (TP), team cohesiveness (TC), social bond (SB) and computing skills (CS), while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year.

The goal-setting structure presented in studies by Huang, Wei, Watson, and Tan (2003) as well as by Kirschner, Beers, Boshuizen, and Gijselaers (2008) was used to measure TC. The elements of SB were complemented measurement of TC, while the study of Shin and Park (2009) was used for this purpose. Social Bond Theory (SBT) is the assumption that individuals will engage in delinquent behavior when their social bond with society is weakened (Hirschi, 1969).

The literature of virtual teams falls into two major categories: the benefits and problems of virtual working compared with F2F (Bordia, 1997; Borges, Brezillon, Pino, & Pomerol, 2007) and the factors that impact virtual team success (Lu, Watson-Manheim, Chudoba, & Wynn, 2006). This research study addressed the two categories but focused in the success of team formation as measured by the level of TC, SB, CS and TP of virtual teams using different CMC tools.

Christodoulopoulos and Papanikolaou (2007a) stated that, “group work, under proper conditions, encourages peer learning and support, providing an opportunity for students to clarify and refine their understanding of concepts through discussion and rehearsal with peers” (p. 117). Social interaction within an online framework can help

team members share experiences and collaborate on relevant topics (Liccardi et al., 2007). The current role of CMC is to provide a public forum that enables the exchange of digital information, such as pictures, videos, text, blogs, and hyperlinks, between users with common interests, such as hobbies, work, school, family, and friendship (Sledgianowski & Kulviwat, 2009). This research study added to that body of knowledge and provided information about how CMC can influence group formation in virtual teams.

The first goal of this research study assessed if there are significant differences in the role of CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of a team formation as measured by the level of task performance, perception of cohesion, and perception of social bond. A study by Branson, Clausen, and Sung (2008) showed the differences in work product between virtual and F2F teams. They concluded that more research is needed because their study uncovered empirical evidence that "for virtual teams to be as effective as F2F teams, people who work on virtual teams will have to learn more about the limitations and problems with virtual teaming, and develop effective strategies to overcome those limitations" (p. 69). This research study selected a list of tasks for individuals in teams based on the work of Levy (2006b; 2008) as well as the work of Zhang, Ayres, and Chan (2010). The second goal this research study assessed if there were any significant differences in the role of CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation, as measured by the level of task performance, perception of cohesion, perception of computing skills and perception of social bond, when controlled for demographic information such as gender, age, education level, academic major, and academic year.

Three teams were compared in this study. Each team of individuals were formed in different ways. These teams were evaluated and measured by the level of TP, TC, CS and SB. The success of the cohesiveness was measured by the four elements of the SBT that appear in Hirschi's work (1969).

Hirschi (1969) developed SBT using four elements: attachment, commitment, involvement, and beliefs. The *attachment* element refers to the symbiotic linkage between a person and society; *commitment* refers to the investment an individual has in social activities; in the *involvement* element, Hirschi (1969) postulated that large amounts of structured time spent in socially-approved activities reduce the time available for deviance; and the *belief* element refers to the moral validity of shared social values and norms (Alston, Harley, & Lenhoff, 1995). SBT demonstrates that people can be controlled in an environment if they belong to groups that have strong ties (Shin & Park, 2009). According to Shin and Park (2009), competent individuals in highly cohesive groups will be influenced by other members due to strong SB; consequently, TC will weaken the individual competency-performance relationship.

The study concentrated on social dimension factors, such as relationship building that is an aspect of both SB and cohesion, which are crucial for the success of virtual teams (Chang & Bordia, 2001; Gillam & Oppenheim, 2006). Relationship building and cohesion have been associated in virtual teams with better performance and satisfaction (Lurey & Raisinghani, 2001). Cohesion has been considered the most important small group variable (Lott, A., & Lot, B., 1965). According to Lin, Standing, and Liu (2008), “team cohesion is the degree to which team members identify with each other and with the team as a whole, and the level of team integration has been found to have a positive

relationship with team performance and satisfaction" (p. 1033). However, Lurey and Raisinghani (2001) did not examine randomly selected individuals. Also, the studies prove that cohesion in virtual teams has a positive relationship with group performance, however these studies have not investigated the use of CMC as the way of group formation (Lin et al., 2008; Lurey & Raisinghani, 2001). Another limitation of these studies was that the nature of the participating teams might have directly impacted the scope of their research. This means that the virtual teams that participated were of different types and came from different scenarios. Another limitation is that the tasks performed were not controlled. According to Lurey and Raisinghani (2001), "the nature of the tasks may have been such that average and superior teams would produce the same performance, thereby masking some of the effects" (p. 531). The current study attempted to investigate the areas that the study of Lurey and Rasinghani (2001) did not consider. The importance of the Lurey and Rasinghani (2001) study is that cohesion is related to success in a virtual team. The cohesion variable appears to have significant impact on the performance of a team, and, therefore, the success of it.

This study builds on previous research conducted by Lin et al. (2008), who proposed a model to develop effective virtual teams. Some of the measurement items of Lin et al. (2008) were used for this research study. The intention of this study was to investigate if the addition of CMC provides significant benefits in overcoming the difficulty of group formation and collaboration between individuals in virtual teams. By influencing teams to use CMC as their medium for group formation, this study can help organizations identify ways to create these teams in the virtual world. Furthermore, this study verified previous research findings as well as advance the literature by identifying

productive directions for future research. The current study compared three groups: Group A (F2F), Group B (OLS), and Group C (OLS+SNS). Group A included individuals from an on-campus course, forming groups F2F in class to work on some tasks, and will serve as the control group for the proposed research. Group B included individuals from an OLS, forming groups assigned by the professor in virtual teams using a traditional discussion board online to work on the same tasks in the system. Group C included individuals from an OLS, forming groups in virtual teams using SNS to work on the same tasks in the system using a discussion board provide by the OLS.

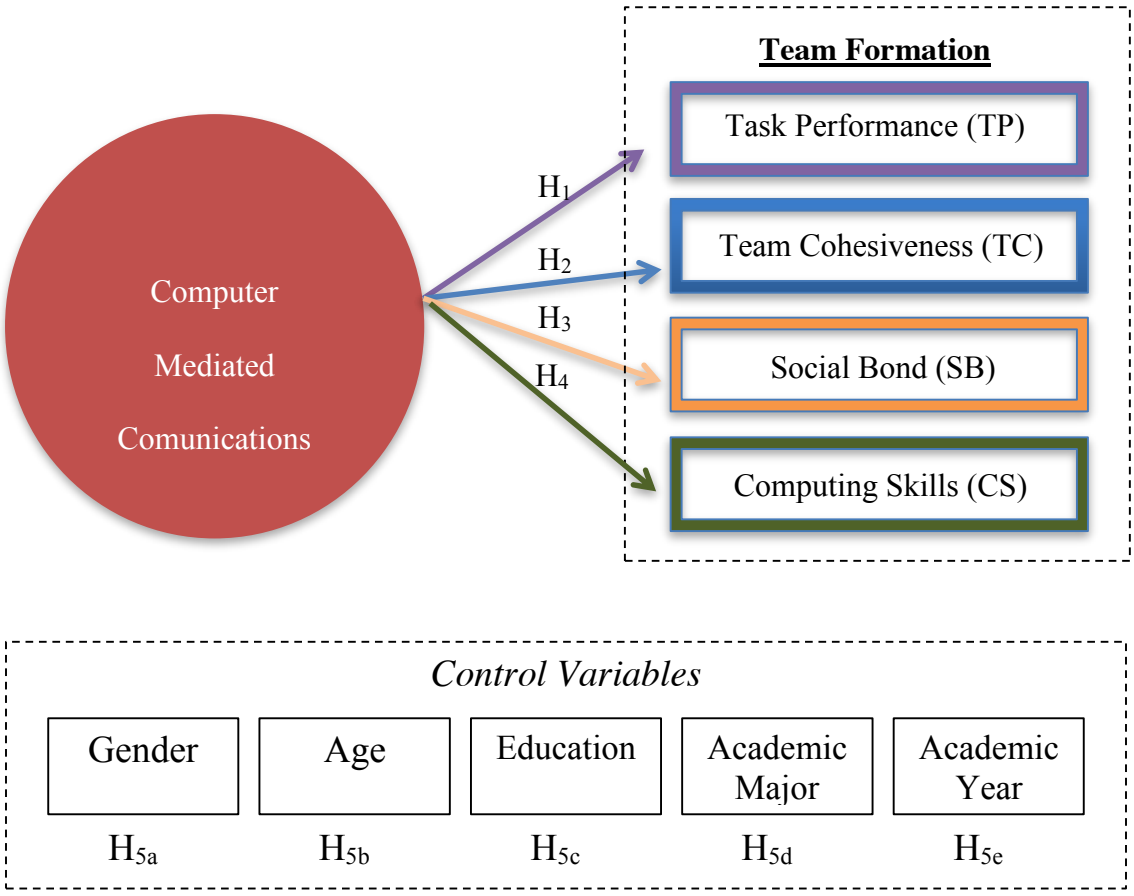

Figure 1. Conceptual Model for Team Formation Success.

Hypotheses

The hypotheses that this study addressed were (in the null form):

H1: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of *TP* in team formation.

H2: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *cohesion* in team formation.

H3: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *SB* in team formation.

H4: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *CS* in team formation.

H5: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the success of team formation as measured by the levels of *TP*, perception of cohesion, perception of *SB* and perception of *CS* when controlled for demographic information such as *gender*, *age*, *education level*, *academic major*, as well as *academic year*.

More specifically:

H5a: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *gender*.

H5b: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *age*.

H5c: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *education level*.

H5d: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic major*.

H5e: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic year*.

The hypotheses are represented in the conceptual model for team formation success (figure 1).

Relevance and Significance

Individuals in virtual environments confront the difficulty of forming teams to work on tasks. This research study evaluated the success of team formation and investigated how the use of CMC can contribute to this success. The novelty of this study was based on the examination of the contribution and the role of CMC in the success of a virtual team. The findings were developed and contributed to the existing body of knowledge, with an emphasis on analyzing how SNS can afford members functionality in the difficulty of team formation and collaboration between individuals in virtual teams. The need for this proposed research is underscored by a previous study conducted by Lin et al. (2008), which proposed a model to develop effective virtual teams. Lin et al. (2008) stated, “social aspects of virtual team development are critical to their performance and

satisfaction and must be considered at the outset of the virtual team development process" (p. 1039).

The main relevance and significance of this proposed study is the investigation into how CMC can contribute to the success of team formation in virtual teams, especially how social factors, such as relationship building, are crucial for the success of virtual teams (Chang & Bordia, 2001; Gillam & Opphenheim, 2006). This research study investigated how organizations can establish an initial framework for using SNS to create TC in virtual teams.

Limitations and Delimitations

Limitations

One limitation of this study was the generalizability of the sample. It was limited to an educational environment, so generalizability to a work setting may be limited as well. The sample of this study included students taking online courses in the School of Health Professions at the University of Puerto Rico in the Medical Sciences Campus. College students are more likely than non-students to take online courses and this kind of learning is beginning to act as a complete substitute for both distance learning and the traditional F2F class (Hiltz & Turoff, 2005).

Another limitation was the potential for participants to not answer truthfully when asked about team formation and their experience doing the tasks for the course. The survey instrument that was used in this study, was validated and the items were used in prior studies. A panel of experts reviewed the final version of the complete survey instrument in order to add to the clarity and validity of the instrument. Additionally, no

personally identifiable information was collected and participants were informed regarding the anonymity of the study prior to the start of the survey.

Delimitations

The university where the study was conducted had limited participant to students taking online classes offered by the School of Health Professions. Therefore, the total population size is limited; it was not limiting the size enough to preclude the study.

Barriers and Issues

Notwithstanding the level of research interest in virtual teams, there is still uncertainty regarding how group formation in these teams can be a success. According to Paul, Seetharaman, Samarah, and Mykytyn (2004), “it is not uncommon for organizations, especially those that span across nations, to group people from different locations into virtual teams” (p. 303). Virtual teams are the answer to the evolving needs for the organization, but the use of them leads to many challenges (Paul et al., 2004).

Virtual teams' lack of social interaction manifests in different ways, compared with traditional teams. According to Paul et al. (2004), “virtual teams offer lower levels of social presence and information richness than F2F meetings” (p. 304). That is the reason that this research study compared different types of groups, including a group of individuals who will form F2F groups to work on some tasks as virtual teams in an OLS and had served as the control group for this study.

Because the requirements for the research study involved a user survey as well as cooperation and collaboration on the individual's end, the human factor had some effect on the quality of the data collected. Also, the accuracy of the survey depends entirely on

the alertness of the individuals participating; the quality of the data may vary as the attentiveness of the participants does. Another concern that was consider was the receptivity of the individuals using the OLS to work on some tasks and the use of SNS for collaboration.

This research study experienced three possible and significant issues. The first involves the participation of the individuals to complete the tasks using the OLS. The current study had no guarantees that participants will make proper use of the tools, a necessary step to collect the data for the study; nor are there guarantees that participants will even finished the survey. The study mitigated these issues with instructions in how to complete the tasks using the different tools in the OLS and promoted in several messages the completion of the survey to collect the data.

The second potential issue was the sample size. In this research study, the sample was collected at the University of Puerto Rico – Medical Sciences Campus. This campus had over 2,400 enrolled students in 2012 and approximately 400 residents. The students at the School of Health Professions were the participants of this research study. The School of Health Professions has 18 programs; eight graduate programs and 11 undergraduate. The student population is around 550. This research study selected a sample of students from among the 18 programs, based on their skills using the OLS at the school. Some problems with the sample arisen, such as members of the population were inadequately represented in the sample and individuals chosen for the samples were unwilling or unable to participate in the survey. The researcher tried to keep these issues at the minimum with the use of the tools in the OLS.

Definition of Terms

Cohesiveness – the result of all forces acting on all the members to remain in the group (Cartwright, 1968).

Computer-Mediated Communications (CMC) - refers to the use of computers to facilitate interaction between spatially separate learners; these technologies include electronic mail, computer conferencing, and online databases (Jonassen, Davidson, Collins, Campbell, & Haag, 1995).

Computer-Supported Collaborative Learning (CSCL) – learners that communicate with each other via text-based, asynchronous discussion boards (Weinberger & Fischer, 2006).

e-learning - technology-based learning in which learning materials are delivered electronically to remote learners via a computer network (Zhang, Zhao, Zhou, & Nunamaker, 2004).

Social Bond Theory (SBT) - the assumption that persons will engage in delinquent behavior when their bond to society is weakened (Hirschi, 1969).

Social Networking Site (SNS) - a Website that allows users to post their profiles and create personal networks for exchanging information with other users (Weaver & Morrison, 2008).

Team cohesion - the degree to which team members identify with each other and with the group as a whole (Lin et al., 2008).

Virtual Teams – groups of geographically, organizationally and temporally dispersed individuals brought together by information and telecommunications technologies to

accomplish one or more organizational tasks (Paul & Ray, 2009; Powell, Piccoli, & Ives, 2004).

Summary

In chapter one of this study, the research problem, research goals and hypotheses were introduced. The addressable research problem of this study is the difficulty of team formation and collaboration between individuals in virtual teams (Liccardi et al., 2007; Ounnas, 2008). Prior research was presented providing the theoretical foundation for this study. The theoretical foundation provides the basis that shape the constructs to be studied including TC, SB, CS and TP, as well as the control variables of gender, age, education, academic major and academic year. The definition of virtual teams is presented also.

The main goal of this study is presented in chapter one. That goal is to assess the role of different CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance (TP), team cohesiveness (TC), social bond (SB) and computing skills (CS), while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year.

Chapter one also presents the relevance and significance of this study. The main relevance and significance of this research study is the investigation into how CMC can contribute to the success of team formation in virtual teams, especially how social factors, such as relationship building, are crucial for the success of virtual teams (Chang & Bordia, 2001; Gillam & Opphenheim, 2006). This research study investigated how

organizations can establish an initial framework for using SNS to create TC in virtual teams.

Additional sections at the end of chapter one included a discussion of the barriers and issues that affected this research. The final sections of chapter one defined the key terms that were used in this study.

Chapter 2

Review of the Literature

Introduction

In recent years, researchers focused specifically on the use of social networking sites in facilitating collaborative work (Shen, Cheung, Lee, & Wang, 2008). The growth of the Internet, coupled with the technological advancements of the last few years, triggered the explosive development of these CMC. According to Breakenridge (2008), SNS comes down to the individual; that person has a social network and he/she wants to try to organize friends, essentially because communication is so much easier and quicker these days. Most CMC cater primarily to individualistic or personal motivations and goals (e.g. they allow users to store their pictures, bookmarks, or videos); they facilitate one-to-one or one-to-many communication and the publishing of ideas (Wever, Mechant, Veevaete, & Hauttekeete, 2007). A CMC, while it enables personal motivation, creates a new kind of almost effortless cooperation. It creates weak ties between casual acquaintances who did not previously have any cooperative action plan or altruistic intention. The success of Web 2.0 services reveals the user's hybrid motivation, where the individualization of the user's goals meets the opportunity of sharing personal expression in a public sphere (Wever et al., 2007). These kinds of tools can influence the success of group formation in virtual teams.

According to Paul, Seetharaman, Samarah, and Mykytyn (2005), "virtual teams are temporally and geographically dispersed groups, which may have members from varied cultures and backgrounds" (p. 1). Historically, teams have had experiences of

geographical and temporal limitations problems. Members of teams have had to postpone meetings until all members were available at the same time and in the same place. With the improvement of technology in telecommunications, individuals are moving to virtual teams. Maynard and Mathieu (2012) stated that one trend that is increasingly common in today's team-based settings include working in virtual communications. With virtual teams, while individuals do not have the problems imposed by geography, time and organizational boundaries, other problems arise (Erez at al., 2013; Malhotra, Majchrzak, & Rosen, 2007; Maynard & Mathieu, 2012).

History and the Evolution of Virtual Teams

Global competition and the need to respond quickly to customers' needs are just some of the more pronounced trends driving organizational change (Grenier & Metes, 1995). According to Powell, Piccoli, and Ives (2004), "successful organizations are those organized in a dynamic network form that, using Information Technology (IT) as a primary enabler, can more quickly adapt to ever-changing competitive landscapes and customer requirements" (p. 6). Virtual teams are one of the elements for these successful organizations.

Among the different definitions of the concept of a team, that by Cohen and Bailey (1997) is one of the most widely accepted:

> A team is a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems (for

> example, business unit or the corporation), and who manage their relationships across organizational boundaries. (p. 241)

What defines a team is its "unity of purpose, its identity as a social structure, and its member's shared responsibility for outcomes" (Powell et al., p. 7).

Virtual teams are historically new. In terms of virtual teams, the literature indicates that this concept has grown and there has been a proliferation of definitions (Martins, Gilson, & Maynard, 2004). According to Lipnack and Stamps (1997), "it was not until the 1990s that the word "virtual" made it into the headlines on a regular basis" (p. 5). They use a myriad of new electronic technologies every day to cope with opportunities and challenges. According to Jarvenpaa and Leidner (1999), the distinctive characteristics of virtual teams include that they are geographically and organizationally dispersed collections of individuals who rely primarily on ICTs to accomplish one or more organizational tasks. Miles and Snow (1986) stated that a virtual team is an evolutionary form of a network organization. The concept is enabled by advances in ICT (Davidow & Malone, 1992; Jarvenpaa & Ives, 1994). *Virtual* implies permeable interfaces and boundaries; project teams that rapidly form, reorganize, and dissolve when the needs of a dynamic marketplace change; and individuals with differing competencies who are located across time, space, and cultures (Kristof, Brown, Sims, & Smith, 1995; Mowshowitz, 1997).

Today, virtual teams have become almost indispensable to organizations (Paul & Ray, 2009). According to Paul and Ray (2009), "global virtual teams have now become critical mechanisms for integrating information, making decisions, and implementing plans around the world" (p. 1). In this era of globalization and ever-changing

environments, distributed working groups need to develop a competitive advantage. One problem a virtual team faces is its formation in this digital environment. People have differences, and in a virtual team environment, much of the time, people do not see each other's faces. For this reason, when a virtual team is created, it cannot be determined in advance if the team formation will lead to success.

According to Paul and Ray (2009), virtual team members use CMC, which in many cases have low levels of media richness and are incapable of transmitting non-verbal cues -- with the of exception video conferencing. The problem with the video conferencing method is the high bandwidth requirements and the inability to support side conversations. Another problem with virtual teams is the interaction between the members and the development of trusting relationships in this environment. Virtual team members need open interaction and participation in group-work; this depends on team members' perception of the work environment and on the elements of trust, respect, and open conflict norms that are essential for a favorable work atmosphere (Paul & Ray, 2009). According to Jarvenpaa and Leidner (1999),

> as companies expand globally, face increasing time compression in product development, and the use of more foreign-based subcontracting labor, virtual teams promise the flexibility, responsiveness, lower costs, and improved resource utilization necessary to meet ever-changing task requirements in highly turbulent and dynamic global business environments. (p. 791)

Table 1. Summary of Virtual Teams related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
Powell, Piccoli, & Ives, 2004	Review of Literature	Forty-three articles and information on several dimensions	Technology adoption and use, trust, leadership, communication, design, effectiveness	1. List of issues that have been examined by virtual team research. 2. Categorize the literature. 3. Research questions organized around inputs, socio-emotional processes, task processes, and outputs.
Erez, Lisak, Harush, Glikson, Nouri, & Shokef, 2013	Collaborative experiential-learning approach, consisting of experienced-based cycles of acquiring new knowledge, experimenting, and reflecting upon the process	1221 MBA and graduate students from 17 universities in 12 countries who took part in the Multicultural Team Project, in four projects in four consecutive years	Cultural Intelligence was measured by the Cultural Intelligence scale (20 items using a 7-point Likert scale). Global Identity was measured by the Global Identity scale (5 items using a 7-point Likert scale). Local Identity was measured by Local Identity scale (5 items using a 7-point Likert scale). Team	1. Developed and implemented an online management education program designed for acquiring global characteristics. 2. Enriching the research literature on global, virtual multicultural teams.

Table 1. Summary of Virtual Teams related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
			trust was measured by the scale developed by Spreitzer, Nobel, Mishra, Cooke, and Wageman(1999) (5 point Likert scale).	
Jarvenpaa & Leidner, 1999	Case Study	350 master's students from 28 universities	A modified five-point scale version of Schoorman et al.'s instrument (1996) and a modified five-point scale measure of trustworthiness from Pearce et al. (1992)	1. Uncertainty in virtual environments. 2. Such uncertainties militate against the development of trust and challenge the viability and longevity of global virtual teams. 3. Trust may not be possible in global virtual teams. 4. Trust can exist in teams built purely on electronic networks.
Paul & Ray, 2009	Computer laboratory experiment with volunteer subjects.	27 three-member groups	The study involved one independent variable (cultural diversity of virtual teams), and three major dependent	1. Teams may not express task conflict unless the group members form favorable perceptions about the work environment

Table 1. Summary of Virtual Teams related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
			variables (the perception of work atmosphere, task conflict, and participation)	and participate in-group work. 2. The issue of cultural heterogeneity is complex and has interesting relationship with group members' perception of the work environment in virtual teams.
Maynard & Mathieu, 2012.	Tested an hypothesized model using a sample of global virtual supply chain teams.	68 supply chain teams	A multi-item 7-point Likert scale measuring team effectiveness, transactive memory systems, preparation activities, interdependence and team virtuality.	1. Transactive Memory Systems (TMS) are positively related to team effectiveness. 2. Preparation activities exhibited a positive, significant relationship with TMS, which in turn drives team effectiveness. 3. The impact of members outside attentional demands on team functioning and effectiveness
Martins, Gilson, & Maynard, 2004	Review of literature	93 empirical articles	The inputs-processes-outcomes model	1. Virtual teams are increasingly prevalent in organizations.

Table 1. Summary of Virtual Teams related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
				2. All organizational teams are virtual to some extent. 3. Virtual teams can enhance the competitive flexibility of organizations

Team Cohesiveness (TC)

According to Wang, Lin, and Sun (2007), team formation is a known problem. Munkvold and Zigurs (2007) stated, "virtual teams are formed in response to specific needs and typically must perform quickly" (p. 287). They need a rapid start-up, and usually individuals in these virtual worlds are people who have no prior knowledge of the others on the team and they need to work together immediately (Munkvold & Zigurs, 2007). Identifying the correct people to solve a problem efficiently or collaborate with others is a challenging task (Liccardi et al., 2007). Teams are formed for the purpose of performing a task or a series of related tasks (Guzzo & Salas, 1995). Organizations make great efforts to find ways to configure work done in face-to-face teams, and now the formation of virtual teams faces a new level of complexity (London, 2001).

Schwanda et al. (2011) stated that "team cohesiveness is a vital social dynamic that is difficult to achieve in virtual teams" (p. 709). They also indicated that members of highly cohesive groups tend to be more satisfied with their experience than those in less cohesive groups. Powell et al. (2004) stated that "high levels of communication early in

the life of virtual teams foster team cohesiveness. High levels of cohesiveness reduce barriers to communication and are instrumental in promoting a virtuous cycle of cooperation" (p. 16). Jarvenpaa and Leidner (1999) indicated that early communication and interaction have lasting effects on trust in the virtual environment.

Literature has shown that diversity yields both advantages and disadvantages in the effective functioning of groups (Jackson, 1991). According to Paul and Ray (2009), heterogeneous groups are more creative and more likely to reach high-quality decisions than homogeneous groups. This can increase the potential productivity of a group (Jackson, 1991). Individuals from different cultures bring a variety of perspectives and outlooks to a task, and this diversity may add to the pool of resources available to a group (Adler, 1990). However, this research study will not measure diversity because of the uncertainty of the measure explained by the literature above.

Measuring TC has occupied the attention of researchers for a long time, and in previous studies, team members' perceptions of TC have been the basis for measuring this construct (Salisbury, Carte, & Chidambaram, 2006). Perceived cohesiveness encompasses an individual's sense of belonging to a particular team (Bollen & Hoyle, 1990). According to Salisbury et al. (2006), "perceived TC reflects an individual's appraisal of their relationship to the team" (p. 147). The perception by individuals relative to their group can be connected to the success of team formation (Chidambaram, 1996). This is why it was so important to examine the construct of team cohesion in this research study.

Christodoulopoulos and Papanikolaou (2007a) stated that, "group work, under proper conditions, encourages peer learning and support, providing an opportunity for

individuals to clarify and refine their understanding of concepts through discussion and rehearsal with peers" (p. 117). Social interaction within an online framework can help team members share experiences and collaborate on relevant topics (Liccardi et al., 2007). With the use of SNS as the tool of team formation, this research study investigated the success of the virtual teams measured by the TP, TC, SB and CS.

Table 2. Summary of Team Cohesiveness related literature

Study	**Methodology**	**Sample**	**Instrument/ Constructs**	**Main findings or contribution**
Wang, Lin, & Sun, 2007	Survey	66 freshmen enrolled in an introductory computer science class at a technical university in northern Taiwan	Executive thinking style, legislative, thinking style and judicial thinking style	1. Participants grouped by DIANA system completed a significantly larger percentage of tasks. 2. Learning styles strongly affect group learning outcomes.
Liccardi et al., 2007	Review of Literature	Pedagogy from a student perspective, concentrating on the computer science culture	Students social networks	1. The paper demonstrate the social dimensions of a collaborative learning network, its formation, its presence and its influence on different social networks in education. 2. Benefits of Web 2.0 3. Connection between the learning practices and social networks.

Table 2. Summary of Team Cohesiveness related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
Schwanda et al., 2011	Participants were randomly assigned to a four-person group and given 30 minutes to complete the "Wilmore Homicide" task over online chat	112 participants for a "Murdery Mystery Study"	Groups reaching consensus on the collaborative task and whether they were successful and came to the correct solution	1. Presents a preliminary analysis of temporal patterns of group cohesiveness when groups with different types of leaders complete a collaborative task over online chat. 2. Successful groups are more cohesive than unsuccessful groups from the beginning, but both groups become less cohesive over time.
Salisburry, Carte, & Chidambaram, 2006	Data from quasi-experimental groups working on a database project. Survey instrument was administered electronically.	110 undergraduate respondents were chosen from introductory database classes at three universities	Cohesion	1. Virtual teams may struggle with cohesion but their perception of what cohesion is does not differ from that of collocated teams. 2. Validation of Chin et al. (1999) cohesiveness measure.

Social Bond (SB)

The social bond theory has remained a major paradigm since its introduction in 1969 (Pratt, Franklin, & Gau, 2011). According to Hirschi (1969), virtually all existing criminological theories began with a faulty fundamental premise: that criminal behavior requires the creation of criminal motivation. Hirschi (1969) postulated that all of us possess the drive to act in the kinds of selfish and aggressive ways that lead to criminal behavior and that it is part of our innate human nature. The question that Hirschi (1969) asked was, why the rest of the population does not participate in that criminal behavior?

According to Pratt et al. (2011), "for Hirschi, the answer could be found in the bonds that people form to prosocial values, prosocial people, and prosocial institutions" (p. 58). It is these SB that end up in controlling our behavior when we are tempted to engage in criminal or deviant acts (Hirschi, 1969). These bonds come in four interrelated forms: attachment, commitment, involvement and belief (Pratt et al., 2011). Attachment, according to Hirschi (1969), refers to the level of psychological affection one has for prosocial others and institutions. Pratt et al. (2011) explained that, "for Hirschi, parents and schools were of critical importance in this regard, where youths who form close attachments to their parents and schools will, by extension, experiment greater levels of social control" (p. 58).

Commitment, according to Hirschi (1969), is the second type of SB where people value social relationships, which they would not want to risk jeopardizing by committing criminal or deviant acts. Hirschi (1969) explained that people are less likely to misbehave when they know that they have something to lose (Pratt et al., 2011). The third type of SB is involvement. According to Pratt et al. (2011), involvement relates to the opportunity

costs associated with how people spend their time. According to Hirschi (1969), if people are spending their time engaged in some form of prosocial activity, then they are not, by definition, spending their time engaged in antisocial activity.

Pratt et al. (2011) described the final type of social bond identified by Hirschi (1969),

> as the degree to which one adheres to the values associated with behaviors that conform to the law: the assumption being that the more important such values are to a person, the less likely he or she is to engage in criminal/deviant behavior. (p. 59)

Alston, Harley and Lenhoff (1995) stated that according to the theory of social control there is an important link between attitudes and behavior - not in the sense that attitudes motivate people to commit crime, but rather that prosocial attitudes constrain people from committing the crimes they otherwise would have in the absence of such social bonds. According to Pratt et al. (2011), "the most significant element of Hirschi's theory is that these SB combine in a way that controls our behavior indirectly - that is, we do not need to have these bonds directly present in our lives to keep our behavior in check" (p. 59). This is why SB is very important to hold virtual teams together.

Table 3. Summary of Social Bond related literature

Study	**Methodology**	**Sample**	**Instrument/ Constructs**	**Main findings or contribution**
Hirschi (1969)	Social Bond Theory	N/A	Attachment, commitment, involvement and belief	1. Hirschi (1969) provided a set of operational measures for certain key variables specified by each of the

Table 3. Summary of Social Bond related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
				major theoretical traditions in criminology. 2. Developed social bond items 3. Developed indicators of cultural deviance and strain.
Pratt, Franklin, & Gau, 2011	Review of Literature	N/A	Attachment, commitment, involvement and belief	1. The work of Hirschi (1969) provided the field with a new idea and a new way of thinking about people behavior that made sense to the field at the time. 2. The way Hirschi (1969) went about presenting that idea has fundamentally changed the way criminologists to business to this day.

Task Performance (TP)

TP of teams has been among the earliest research topics in different studies starting with the studies of Triplett (1898). According to Triplett (1898), children showed

more effort on a coactive task when other children were present, compared with situations where they were performing alone. While it is generally accepted that virtual teamwork has considerable cost and flexibility benefits, there is some question whether the benefits outweigh possible performance losses arising from virtual versus F2F work (Corbitt, Gardiner, & Wright, 2004). According to Corbitt et al. (2004), "computer mediated groups tend to perform better than F2F groups on idea generation tasks but worse on more complex tasks with computer-mediated groups typically having longer task completion times" (p. 3).

Optimal team composition in virtual settings may be different from traditional teams (Turel & Zhang, 2010). Sproull and Kiesler (1986) stated that virtual teams lack the timely verbal cues and facial expressions that prevail in face-to-face team interactions and, as such, find it more difficult to become cohesive and to perform well. According to Chidambaram and Tung (2005) reported virtual teams often present heightened levels of social loafing and frequently struggle to build trust and relationships among team members (Jarvenpaa, Knoll, & Leidner, 1998), which are crucial for team performance (Lin et al., 2008). Given these attributes, whereas in traditional teams loose leadership may suffice, strong emergent leadership may be required in virtual settings to prevent the prevalent phenomenon of social loafing that will affect a virtual team's TP (Chidambaram & Tung, 2005).

Table 4. Summary of Task Performance related literature

Study	**Methodology**	**Sample**	**Instrument/ Constructs**	**Main findings or contribution**
Triplett (1898)	Laboratory experiment	40 children	Social facilitation	1. Concluded that children perform a simple lab task

Table 4. Summary of Task Performance related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
				faster in pairs than when performing by themselves.
Corbitt, Gardiner, & Wright, 2004	Survey	48 students	Trust, task time, team performance	1. Trust is related to what a person does on the team and that high trust needs to be created and maintained early. 2. Virtual teams and F2F teams spend similar proportions of time in each team formation stage. 3. In this study the direction of effectiveness leans towards the virtual teams.
Turel & Zhang, 2010	Survey	290 undergraduate business students in a management information systems course, who were randomly assigned to 90 three-person virtual teams and 5 four-person virtual teams (a total of 95 teams),	Extroversion, conscientiousness, perceived problem solving, team performance	1. The study demonstrated that the configuration of virtual teams, and the attributes of individuals who compose the team, are issues that managers should consider before assigning individuals to self-managed virtual teams. 2. It is not just about the

Table 4. Summary of Task Performance related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
		comprised of individuals from different course sections		number of people on a virtual team, but also about the team composition.
Jarvenpaa, Knoll, & Leidner, 1998	Survey	385 masters students from 28 universities around the world	Benevolence, ability, integrity, trustworthiness, trust, and propensity to trust	1. The team-building exercises had a positive effect on the perceptions of other members' integrity, ability, and benevolence, they did not have a direct effect on trust. 2. Team trust was predicted more strongly by perceptions of other team members' integrity, and least strongly by the perceptions of their benevolence. 3. High-trust teams exhibit swift trust.
Lin et al., 2008	Field experiment and survey	200 students	Relationship building, Cohesion, Communication, Coordination, Performance and Satisfaction	1. The study identified several social and task dimensional factors which had affected the effectiveness of virtual teams via

Table 4. Summary of Task Performance related literature

Study	Methodology	Sample	Instrument/ Constructs	Main findings or contribution
				the meta-analysis. 2. The results indicated that communication had no significant direct impact on the effectiveness of virual teams; virtual teams focused more on social dimensional factors than the task-oriented factor; social dimensional factors could only affect the satisfaction of virtual teams indirectly through their performance and there was no significant relationship between the task dimensional facto and the effectiveness of virtual teams.

Computing Skills (CS)

In today's computing environment, Torkzadeh and Lee (2003) stated that "the bottom line is not how good information systems (IS) are, but rather how well they are

used" (p. 607). As computing technology is used in one form or another in all fields, it is imperative that individuals have proficiency in the area of computing technologies (Hanebutte, 2013). According to Hanebutte (2013), "the level of computing technology literacy does not appear as high as expected from industry, and individuals are not as comfortable with the use of computing equipment as they were a few years ago" (p. 87).

Kurdel, Lazar and Labun (2014) stated that "a skill can be defined as a conscious activity to perform certain tasks as fast as possible in time and with required result" (p. 375). This is why computing skills are important in virtual teams. Effective use of computing technology is considered by Torkzadeh and Lee (2003) a "major determinant of economic growth, competitive advantage, productivity, and even personal competency" (p. 607). Computing skills influence how well computing technology is used by individuals. As an example, individuals understand how to use a web browser. However, according to Hanebutte (2013), beyond the knowledge of understanding how to use a web browser, there is often very little comprehension about how web pages are transported and displayed. According to Fernandez (2009), "successful computing professionals will need personal skills and developing the personal skills in organizations will be very important" (p. 111).

Demographic Information

Previous studies have shown demographics to be an important factor in the use of CMC in OLS (Powell et al., 2004). The current study identified participants' gender, age, highest education degree achieved, program enrollment, and years in a program of study (D'Souza & Colarelli, 2010; Janssen, Erkens, Kirschner, & Kanselaar, 2009). Also, this

research study collected information to identify which of the two genders exhibits the greater use of CMC tools (Boyd & Ellison, 2007).

What is Known and the Unknown about Virtual Teams

As the literature on virtual teams grows, there is an explosion of attempts to describe the concept. Martins, Gilson, and Maynard (2004) stated, “an examination of the definitions used indicates that there is considerable overlap in the core definition, with some small variation in the specifics" (p. 806). Today, the majority of definitions have established that virtual teams are those that rely on ICTs while crossing several different boundaries (Bell & Kozlowski, 2002; Lipnack & Stamps, 1999; Lurey & Rasinghani, 2001; Martins et al., 2004). Martins et al. (2004) stated, the most common boundaries are geography, time, and organization. Virtual teams are not constrained to one physical location and can have members located throughout the world (Montoya-Weiss, Massey, & Song, 2001). Sometimes researchers focus exclusively on "global virtual teams" because of the lack of these geographic boundaries, and the distribution of virtual team members can cross temporal boundaries, like time zones and asynchronous communication media, which limit the interaction in "real-time" (Martins et al., 2004).

There are several known issues that the literature explains regarding virtual teams. The first is the issue of group size, which, according to Steiner (1972), is critical to group performance. Martins et al. (2004) stated, "researchers have noted that teams' size may affect virtual teams differently than face-to-face teams" (p. 809). This argument is based on the idea that technology can mitigate the negative effects of size found in face-to-face decision-making or creative teams (Leenders, van Engelen, & Kratzer, 2003; Valacich,

Dennis, & Connolly, 1994; Valacich, Dennis, & Nunamaker, 1992). The second issue is a benefit -- virtual teams can bring together individuals with the needed knowledge, skills, and abilities, irrespective of their location (Blackburn, Furst, & Rosen, 2003). The third issue is that the type of technology used by virtual teams has been found to have a positive impact on team effectiveness, efficiency, frequency of communications (Carlson & Zmud, 1999; Hinds & Kiesler, 1995; Jarvenpaa, Rao, & Huber, 1988; May & Carter, 2001), commitment (Workman, Kahnweiler, & Bommer, 2003), and relationships among team members (Pauleen & Yoong, 2001).

Sproull and Kiesler (1986) stated, theorists initially argued that group composition regarding variations in status would be less salient within virtual teams; indeed empirical research has found that status influences are reduced in virtual interactions. Nevertheless, not all studies have found that team formation or composition impact virtual teams' decisions (El-Shinnawy & Vinze, 1998; Hollingshead, 1996). Researchers have found that CMC teams tend to recreate hierarchies in an attempt to preserve status differences (Owens, Neale, & Sutton, 2000). Research suggest that status hierarchies may be retained due to the behaviors of high-status members such as talking more, perceiving their contribution as greater, and rating themselves more highly (Weisband, Schneider, & Connolly, 1995).

Researchers have found goal-setting in virtual teams to be positively associated with cohesiveness, commitment, collaboration, decision quality, and numbers of alternatives generated (Huang, Wei, Watson, & Tan, 2003) but there is a need to test virtual team effectiveness (Maynard & Mathieu, 2012). Formalizing work processes and strategies has been also found to be critical to virtual team performance (Lurey &

Raisinghani, 2001). The literature on virtual teams has been devoted to examining the effects of virtual interaction on team affective outcomes and on performance outcomes (Martins et al., 2004). Researchers have examined various contingency factors that may influence the effects of virtual interaction on team outcomes (Baker, 2002; Maznevski & Chudoba, 2000; Straus & McGrath, 1994). For member satisfaction, the effects of virtual interaction appear to be dependent on the nature of the task and on team composition (Cappel & Windsor, 2000). Lower levels of satisfaction are reported in virtual teams than in face-to-face teams (Jessup & Tansik, 1991; Straus, 1996; Thompson & Coovert, 2002; Warkentin, Sayeed & Hightower, 1997). Finally, according to Tan, Wei, Watson, Clapper, and McLean (1998), culture also appears to affect interaction in virtual teams, such that members from individualistic cultures tended to challenge majority positions more often than members from collectivist cultures. In this research study, culture was not measured because all of the participants were in the same country, which tend to be, and was assumed constant. The personality of the members has also been found to influence their participation in virtual teams. Straus (1996) reported that extraversion was positively related to participation in CMC groups.

Contribution of this Study

The contribution of this study is that it added value to the body of knowledge regarding virtual teams. As noted in the literature review, researchers focused specifically on the use of social networking sites in facilitating collaborative work (Shen, Cheung, Lee, & Wang, 2008). The results of this study contributed to the body of knowledge for

both practice and research, to help organizations identify ways to support effective team formations.

Chapter 3

Research Methodology

Introduction

The approach for this proposed research study was based on a quantitative survey instrument to measure and analyze the contributions of CMC in virtual teams. According to Sekaran (2003), a survey is an efficient data collection instrument when the proposed research knows what is required and how to measure the variables of interest. In this current study, the mode of data collection was a Web-based survey instrument. The advantages of a Web-based survey instrument is that is easier to administer, can reach globally, is very inexpensive, can be delivered quickly, and respondents can answer at their convenience (Sekaran, 2003).

According to Mingers (2001), "research is conducted by undertaking particular activities such as administering and analyzing a survey, conducting controlled experiments, doing ethnography or participant observation, or developing root definitions and conceptual models" (p. 241). The basic activities previously described are research methods or techniques (Mingers, 2001). In the case of this research study, it used a quantitative survey to obtain data about how SNS can influence team formation in virtual teams using the measures of team cohesiveness, social bond, task performance and computing skills.

The main goal of the current study was to assess the role of increased CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance, team cohesiveness, computing skills and

social bond, while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year. Three groups were compared: Group A, Group B, and Group C. Group A included individuals from an on-campus course, forming groups F2F in class to work on some tasks and acted as the control group for this research study. Group B included individuals from an OLS, forming groups assigned by the professor in virtual teams using a traditional discussion board online to work on the same tasks in the system. Group C included individuals from an OLS, forming groups in virtual teams using SNS to work on the same tasks in the system using a discussion board provide by the OLS. The learning activities that the study used were from a list designed in a study by Levy (2008). The following activities were applied: a) participating in chat sessions (unofficial with other students), b) sharing assignments with the other students (via discussion forum), c) sharing assignments with the other students (via e-mail), d) sending e-mails to other students, e) reading other students' assignments (via discussion forum), f) replying to students' discussion forum messages, g) reading other students' discussion forum messages, h) reviewing other students' personal Websites, and i) developing personal Website, profile, or blog.

Instrument Development

A survey instrument for the current study was designed to assess empirically the success of team formation and to investigate if differences in the use of CMC contribute to this success. The survey instrument was delivered via the Web using Google Forms.

Web-based surveys are becoming increasingly efficient because of their ease of data collection (Porter & Whicomb, 2003).

The survey instrument gather data regarding TC, SB, TP, demographic information, and computing skills (CS). The current study contributed to the IS literature by demonstrating that these constructs influence the success of group formation in virtual teams. The survey instrument that was used in this research study adopted known constructs and items from the following measures within the IS literature domain:

a. Boyle and Hoyle (1990)

b. Salisbury, Carte, and Chidambaram (2006)

c. Lee, J., and Lee, Y. (2002)

d. Ellington, Dierdorff, and Rubin (2014)

e. Torkzadeh and Lee (2003)

The current study included a five-part survey instrument (see Appendix A). The instrument includes the sections of: (a) Team Cohesiveness, (b) Social Bond, (c) Task Performance, (d) Computing Skills, and (e) Demographic Information. The first section consists of six items (TC1 to TC6) to measure team cohesiveness (TC). The second section contained seven items (SB1 to SB7) to measure social bond (SB). The third section consisted of five items (TP1 to TP5) to measure task performance (TP). The fourth section consisted of five items (CS1 to CS5) to measure computing skills (CS). The final section consisted of five items to gather general information regarding each participant's gender, age, educational program, and number of years in the program of study. All the survey items used a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7). According to Cicchetti, Showalter, and Tyrer (1985), a seven-

point Likert scale is significantly better than a five-category ordinal scale as it can provide more adequate variability of responses.

Team Cohesiveness

According to Seashore (1954), measuring cohesion has occupied the attention of researchers for years. One reason for the focus on team cohesiveness is its importance in mediating team performance (Langfred, 1989). According to Salisbury, Carte, and Chidambaram (2006), "in a majority of previous studies, team members' perceptions of cohesiveness have been the bases for measuring this construct" (p. 147). Cohesiveness involves an individual's sense of belonging to a particular group and his or her feelings of morale associated with membership in the group (Bollen & Hoyle, 1990). This situation can be reflective of an individual's judgment of his or her relationship to a group. The perception by individuals relative to their group could be linked to group formation, maintenance, or even productivity in some situations (Chidambaram, 1996).

Bollen and Hoyle (1990) created the Perceived Cohesion Scale (PCS), a six-item measure reflecting two underlying dimensions of cohesion: belonging and morale. The survey items for the cohesiveness construct in this survey are modified versions of those of Bollen and Hoyle (1990) for the PCS. Appendix A contains the six items (TC1 to TC6) that measured TC of team members.

Social Bond

Social bond theory (Hirschi, 1969) is one of the most cited criminology theories. The theory assumes that all people are inclined to commit some type of crime unless there exists a strong control mechanism, or social bond. In other words, the theory is saying that the probability of people engaging in a crime goes up when social bonds are

weak. Lee and Lee (2002) measured the effects of social bonds based on four factors: attachment, commitment, involvement, and belief. This research study used these four factors to measured participants' perceived social bond. The items for the social bond construct in this survey were developed using the four factors utilized by Lee and Lee (2002). Appendix A contains seven items (SB1 to SB7) that assessed social bond in the team members.

Task Performance

The remarkable rise of CMC and associated developments in people's behavior present research opportunities. According to McCarthy, Pioch, Rowley, and Ashworth (2011), CMC as a phenomenon has triggered growing academic discussion. The TP items in this survey were developed to measure the performance of the team using the CMC tools incorporated into the SNS and OLS. The survey items for the Task Performance construct in this survey were modified versions of those of Ellington, Dierdorff, and Rubin (2014). Appendix A contains five items (TP1 to TP5) that investigated the Task Performance by the participating team members.

Computing Skills

Technology continue to affects the daily tasks of individuals in their workplace (Black, 1998). The CS items in this survey were developed to measure the computing skills of the individuals using the CMC tools incorporated into the SNS and OLS. The survey items for the Computing Skills construct in this survey are modified versions of those of Torkzadeh and Lee (2003). Appendix A contains five items (CS1 to CS5) that investigated the Computing Skills by the participating team members.

Validity and Reliability

Internal Validity

According Straub (1989), "internal validity raises the question of whether the observed effects could have been caused by or correlated with a set of unhypothesized and/or unmeasured variables" (p. 151). Leedy and Ormrod (2005) stated that internal validity refers to the "extent to which its design and the data that it yields allow the researcher to draw accurate conclusions about cause-and-effect and other relationship within the data" (pp. 103-104). According to Ellis and Levy (2009), "establishing internal validity requires examining one or more of the following: face validity, criterion validity, construct validity, content validity, or statistical conclusion validity" (p. 334).

According to Yun and Trumbo (2000), Web-based surveys offer the advantage of eliminating any human intervention that may cause errors in the data while entering responses in a database. This research study used a Web-based survey to prevent these errors. To mitigate threats to internal validity, the research study used existing survey items and an expert panel.

External Validity

According to Leedy and Ormrod (2005), external validity refers to the "extent to which its results apply to situations beyond the study itself" (p. 105). King and He (2005) referred to this concept as the "generalizability of sample results to the population of interest, across different measures, persons, settings, or times. External validity is important to demonstrate that research results are applicable in natural settings, as contrasted with classroom, laboratory, or survey-response settings" (p. 882). This research study anticipated that the results would not be limited to the region or to the

School of Health Professions at the University of Puerto Rico. This research study used demographic measures. These measures helped determine if the data collected was a good representation of the sample and population. Indicators like gender, age, and highest educational degree attained provided evidence to support or refute that the results would not be limited to the university it was collected from only, rather can be generalized.

Instrument Validity

According to Straub (1989) "instrument validation is a prior and primary process in confirmatory empirical research" (p. 162). Instrument validation at any level can be of considerable help to MIS researchers (Straub, 1989). The researcher did a factor analysis with SPSS to confirm the items within the access of constructs. Also, the current study used Factor Analysis via Principle Component Analysis (PCA) to validated the instrument items and to validated the constructs assessed. Finally, this study consulted with an expert panel of professionals to review and validated the quantitative survey instrument. This research study used items from previously published work to add to its validity (Boyle & Hoyle, 1990; Salisbury, Carte, & Chidambaran, 2006; Lee, J. & Lee, Y., 2002; Ellington, Dierdorff, & Rubin, 2014; Torkzadeh & Lee, 2003).

Reliability

According to Leedy and Omrod (2005), reliability is defined as "the consistency with which a measuring instrument yields a certain results when the entity being measured hasn't changed" (p. 31). For reliability, Gefen, Straub, and Boudreau (2000) defined Cronbach's Alpha as the commonly used measure of this concept, for a set of two or more construct indicators (or survey items). Gefen et al. (2000) stated that values range from 0 to 1.0, with higher values indicating higher reliability among the indicators.

Sekaran (2003) defined Cronbach's Alpha as "a reliability coefficient that indicates how well the items in a set are positively correlated to one another" (p. 307). This research study computed Cronbach's Alpha for each construct separately to assess the reliability and the consistency of the constructs. Moreover, 'Cronbach's Alpha if item is deleted' were performed in order to check the reliability of the specific items within the construct. Any item that may reduce the overall constructs' reliability was closely evaluated.

Study Participants

The current study participants were students at the graduate and undergraduate level at the School of Health Professions in the Medical Sciences Campus at the University of Puerto Rico in the US territory of Puerto Rico, in programs that utilize Blackboard as their OLS. The undergraduate programs were: Associate Degree in Dental Assisting with Expanded Functions, Associate Degree in Radiologic Technology, Associate Degree in Ophthalmic Technology, Bachelor of Health Sciences, Bachelor of Health Education, Bachelor of Science with Major in Veterinary Technology, Bachelor of Science in Nuclear Medicine Technology, Bachelor of Science and Post-Bachelor Certificate in Medical Technology, Post-Bachelor Certificate in Dietetic Internship and Post-Bachelor Certificate in Cytotechnology. The graduate programs were: Master in Health Information, Master in Clinical Laboratory, Master in Speech-Language Pathologists, Master in Physical Therapy, Master in Occupational Therapy, Post Doctoral Master of Science in Clinical Research and Doctorate in Audiology.

According to Sekaran (2003), demographic data will help describe the characteristics of the sample. The demographics of the population in this research study

were users of an OLS in the School of Health Professions at the Medical Sciences Campus in the University of Puerto Rico. There were a total of at least 150 potential participants. Demographic data consisting of age, gender, and academic program were collected on each participant. A random sample of this population was selected through a voluntary email solicitation. The current study expected to have 50 participants in each group, totaling 150 participants in the study. Each group (A, B, & C) had 10 teams, with five members in each team. A set of instructions were sent to each participant and the Uniform Resource Locator (URL) where the survey was located.

Data Collection

This study used Google Forms to present the survey instrument to the participants. Following the data collection, the results were downloaded into an Excel spreadsheet for preliminary pre-analysis data cleaning and setting the data for statistical analysis via SPSS. The Web-based survey was sent to various users' participants at the School of Health Professions in the Medical Sciences Campus at the University of Puerto Rico. This study anticipated to have approximately 120 usable responses out of 150 anticipated participants, which would be considered satisfactory for statistically significant results (Shevade & Keerthi, 2003; Komareck & Moore, 2004).

Data Analysis

Pre-analysis Data Screening

To ensure the validity of participants, this study followed a pre-analysis data screening procedure. Levy (2006a) indicated that data analysis involves conducting pre-

analysis data screening to ensure the accuracy of the data collected. Levy (2006b) stated that a pre-analysis data screening "deals with the process of detecting irregularities or problems with the collected data" (p.150). This study followed Levy (2006a, 2006b)'s recommended pre-analysis data screening procedure for several reasons. First, the pre-analysis check the accuracy of the data collected via the survey instrument. The second reason was to eliminate cases with response-set, which is where all responses are marked with the same score on all items in the survey. The third thing was to check for missing data. The Web-based survey instrument was constructed in a way that all items were required, which will eliminate this issue. However, testing for missing data was conducted to ensure the data collected is complete and has no missing data. Finally, multivariate outliers were identified using Mahalanobis Distance analysis and considered for eliminated prior to full data analyses (Webster & Wong, 2008).

Analysis

Sekaran (2003) stated that the objectives of data analysis are "getting a feel for the data, testing the goodness of data, and testing the hypotheses developed for the research" (p. 306). After pre-analysis data screening and checks on reliability and validity are completed, items of each construct were evaluated.

The hypotheses for this study used a causal modeling approach to reach each goal. Gay and Airasian (2003) suggested that causal modeling educational research attempts to identify a causative influence between an independent variable and a dependent variable. Ellis and Levy (2009) defined this research method as focusing on determining if a cause-effect influence exists between one factor and a set of factors. This study had the survey instrument validated by a panel of experts to determine its validity.

The proposed study used a one-way analysis of variance (ANOVA) to analyze H1, H2 H3 and H4. A one-way analysis of covariance (ANCOVA) was used to analyze H5. According to Mertler and Vannatta (2013), "ANCOVA is similar to one-way analysis of variance (ANOVA) in that two or more groups are being compared on the mean of some dependent variable, but ANCOVA additionally controls for a variable (covariate) that may influence the dependent variable" (p. 15). In the case of this research study $p<0.05$, $p<0.01$ and $p< 0.001$, was used as a threshold to reject the null hypotheses, thus, indicating statistical significance among the groups.

Resources

The current study used the telecommunications and computer infrastructure of the School of Health Professions at the Medical Sciences Campus in the University of Puerto Rico. The School of Health Professions is a unit of the Medical Sciences Campus at the University of Puerto Rico. The School addresses the needs of the Puerto Rican community for qualified practitioners in a diversity of specialties within the health care field. The curricula provide the knowledge and skills, and foster the necessary attitudes, to carry out these roles and functions within a health care team. The school has 18 programs; seven graduate programs and 11 undergraduate. Most programs are designed for regular, full-time students, although some offer evening classes for part-time study. All of these programs use the Blackboard OLS platform to offer courses to individuals. With these programs and the use of the technology, the School of Health Professions educates the personnel that Puerto Rico needs to attend to the health needs of the Island.

The current study used the Facebook social network as the SNS for the individuals to communicate and to make their profiles. Individuals will need to know how to use this tool and this research study offered basic training to them. In terms of the OLS, the research study used the Blackboard platform, which is the current learning platform for the courses.

As a final apparatus needed for the research study, the Internet was the most important element. Individuals had access to the Internet at the organization and at their homes. Also, the survey was Web-based, and was hosted on a Google Form.

Chapter 4

Results

Overview

This chapter provides the detailed results of the investigation. The processes used for data collection is included, in addition to the method of statistical analysis used to initiate the data analysis. The survey procedures are presented first, followed by the results of the pre-analysis data screening. Next, demographic data for the sample are presented, then the results of the reliability analysis. The chapter concludes with a summary of the results of this study.

The main goal of this research study was to assess the role of different CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance (TP), team cohesiveness (TC), social bond (SB), and computing skills (CS), while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year. The five specific research hypotheses addressed were:

H1: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of *TP* in team formation.

H2: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *cohesion* in team formation.

H3: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *SB* in team formation.

H4: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *CS* in team formation.

H5: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the success of team formation as measured by the levels of *TP*, perception of cohesion, perception of *SB* and perception of *CS* when controlled for demographic information such as *gender*, *age*, *education level*, *academic major*, as well as *academic year*.

More specifically:

H5a: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *gender*.

H5b: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *age*.

H5c: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *education level*.

H5d: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic major*.

H5e: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic year*.

Data Collection and Analysis

Pre-Analysis Data Screening

There were 143 responses received from the survey respondents. Before the collected data could de analyzed, pre-analysis data screening had to be performed. Pre-analysis data screening was performed to detect irregularities with the collected data. According to Levy (2006), pre-analysis data screening is performed to ensure the accuracy of the data collected, to eliminate cases with response-set, check for missing data, and to deal with extreme cases or outliers. For this study, data accuracy was not an issue as the Web-based survey instrument was designed to allow only a single valid answer for each question. Additionally, data collected did not require any manual input as it was submitted into a Google Form that then, was downloaded as a spreadsheet directly for the analyses. The issue of missing data was also not present for this study as the Web-based survey instrument was constructed in a way that all items will be required, which eliminated this problem. To address the issue of response-sets, a visual inspection of all responses was performed to identify cases that had the same response to all of the survey items. Response-set bias produces pattern of responses that may not correctly correspond to the true stat of affairs (Mangione, 1995). According to Kerlinger and Lee (2000), it is recommended that researchers do analysis of data for potential response-sets, and consider the elimination of any such sets from the research prior to the main data

analysis. In this study, there were three response-set cases in the collected data and they were eliminated due to their severity of including the same score on all measured items.

One of the main reasons for pre-analysis data screening was to deal with extreme cases or outliers. In order to address multivariate extreme cases, Mahalanobis Distance analysis was performed. No extreme cases were found in the collected data. Table 5 details the values that resulted from the Mahalanobis Distance Analysis.

Table 5. Mahalanobis distance extreme values (N=140)

			Case Number	CaseID	Value
Mahalanobis Distance	Highest	1	121	121	73.88771
		2	53	53	73.60704
		3	78	78	72.87044
		4	119	119	70.59686
		5	7	7	65.72489

Demographic Analysis

After completion of the pre-analysis data screening, 140 responses remained for analysis, with demographics that is similar to that of the general sample targeted. Of which, 111 or 79.3%, were completed by females and 29 or 20.7% were completed by males. Analysis of the ages of respondents indicated that 127 or 90.8% were between 19 to 29. Respondents with associates degrees are 33.6% of the population while bachelor's degrees are 31.4%. Overall, 98 respondents or 70% had a university degree prior studying in the program that they have enrolled in the School of Health Professions, 92 or 65.7% were enrolled in an undergraduate program and 85 or 60.7% had one year or less in the program that they have enrolled. Details of the demographics of the population are presented in table 6.

Table 6. Descriptive Statistics of Population (N=140)

Item	Frequency	Percentage (%)
Gender		
Male	29	20.7
Female	111	79.3
Age		
18 or under	0	0
19 to 24	95	67.9
25 to 29	32	22.9
30 to 34	5	3.6
35 to 39	2	1.4
40 to 44	1	0.7
45 to 54	4	2.9
55 to 59	0	0
60 or older	1	0.7
Academic Level		
High school diploma	42	30.0
Associates degree	47	33.6
Bachelor's degree	44	31.4
Master's degree	6	4.3
Professional degree	0	0
Doctoral degree	1	.7
Program Enrolled		
Undergraduate	92	65.7
Graduate	48	34.3
Years in the program of study		
1 year or less	85	60.7
2 to 5 years	54	38.6
6 to 9 years	0	0
10 years or longer	1	.7

Table 7. Descriptive Statistics for each group in population

Item	Group A (N=44)		Group B (N=47)		Group C (N=49)	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender						
Male	14	31.8	5	10.6	10	20.4
Female	30	68.2	42	89.4	39	79.6
Age						
18 or under	0	0	0	0	0	0
19 to 24	35	79.5	24	51.1	36	73.5
25 to 29	7	15.9	18	38.3	7	14.3
30 to 34	1	2.3	2	4.3	2	4.1
35 to 39	0	0	0	0	2	4.1
40 to 44	0	0	1	2.1	0	0
45 to 54	1	2.3	2	4.3	1	2.0
55 to 59	0	0	0	0	0	0
60 or older	0	0	0	0	1	2.0
Academic Level						
High school diploma	26	59.1	16	34.0	0	0
Associates degree	13	29.5	3	6.4	31	63.3
Bachelor's degree	5	11.4	22	46.8	17	34.7
Master's degree	0	0	6	12.8	0	0
Professional degree	0	0	0	0	0	0
Doctoral degree	0	0	0	0	1	2.0
Program Enrolled						
Undergraduate	38	86.4	24	51.1	30	61.2
Graduate	6	13.6	23	48.9	19	38.8
Years in the program of study						
1 year or less	22	50.0	29	61.7	34	69.4
2 to 5 years	22	50.0	18	38.3	14	28.6
6 to 9 years	0	0	0	0	0	0
10 years or longer	0	0	0	0	1	2.0

The population was divided into three groups. This proposed research compared the three groups: Group A, Group B, and Group C. Group A included individuals from an on-campus course, forming groups F2F in class to work on some tasks and acted as the control group for this proposed research. Group B included individuals from an OLS, forming groups assigned by the professor in virtual teams using a traditional discussion board online to work on the same tasks in the system. Group C included individuals from an OLS, forming groups in virtual teams using SNS to work on the same tasks in the system using a discussion board provided by the OLS. Details of the demographics of the population of each group are presented in table 7.

Exploratory Factor Analysis via Principal Component Analysis

The study used PCA to uncover how many components to retain and interpret. The Statistical Package for the Social Sciences (SPSS) software was used to run the PCA for the extraction of components to provide variances of underlying factors (Mertler & Vannatta, 2013). Using Varimax rotation via PCA this study initially extracted as many factors as indicated by the data. No new factors emerged from the analysis.

After conducting PCA using Varimax rotation, the Kaiser criteria was applied to the factor analysis. According to Child (2006), in the Kaiser criterion, only factors having eigenvalues greater than one are considered common factors. The results of the PCA factor analysis suggested that four factors with a cumulative variance of 82.79% should be retained.

To determine the appropriate number of components to retain and to interpret, a scree plot was made (Figure 2) of the magnitude of each eigenvalue plotted against its

ordinal numbers. Examination of the graph indicated that there were four points above the knee of the graph. The number of points above the bend is indicative of the number of factors to be retained. Based on the analysis, it was concluded that the appropriate number of factors for extraction was four.

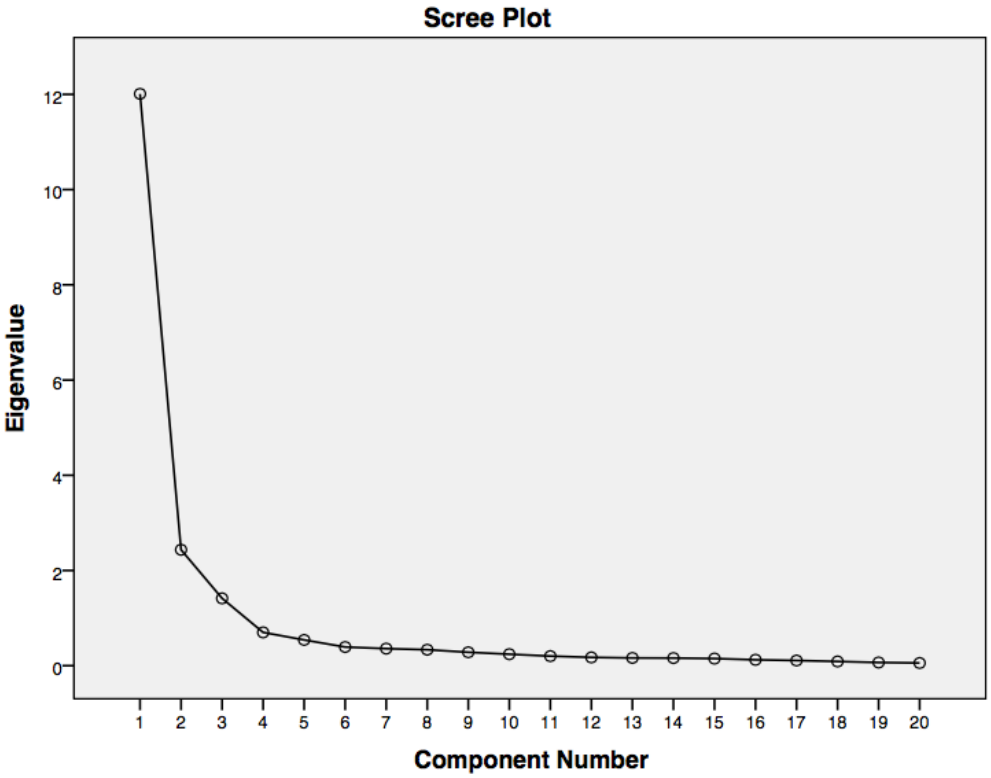

Figure 2. Scree plot for Team Formation

Using the factor loadings, survey items were scrutinized for low loadings (< 0.4) or for medium to high loadings (˜0.4 to 0.6) on four factors. The results of this review indicated that three items could be eliminated from further analysis. Consequently, the final analysis excluded one item of SB and two items of TC. For the SB, SB1 item was removed. For the TC, TC1 and TC3 were removed. Table 8 presents the rotated component matrix of SPSS using Equamax as the rotation method with four components.

Table 8. Rotated Component Matrix using Equamax as the rotation method

	Component			
	1	2	3	4
TP2	.841	.265	.169	.337
TP3	.803	.275	.212	.359
TP1	.793	.302	.264	.314
TP4	.786	.272	.226	.351
TP5	.743	.255	.240	.422
SB5	.289	.807	.175	.256
SB3	.166	.795	.140	.351
SB7	.240	.778	.264	.291
SB2	.224	.730	.273	.362
SB6	.361	.704	.340	.272
SB4	.503	.593	.182	.361
CS3	.049	.146	.900	.151
CS1	.086	.127	.865	.136
CS5	.216	.216	.851	.143
CS2	.226	.267	.841	.098
CS4	.371	.163	.730	.236
TC6	.375	.190	.065	.836
TC5	.138	.376	.225	.759
TC4	.456	.321	.182	.650
TC2	.518	.422	.189	.566

Validity and Reliability Analysis

As part of the data analysis, the reliability of the four constructs that made the Team Formation was verified using Cronbach's Alpha (Cronbach, 1951). Gefen, Straub, and Boudreau (2000) defined Cronbach's Alpha as the commonly used measure for the concept of reliability, for a set of two or more construct indicators (or survey items). According to Boudreau, Gefen and Straub (2001) as well as Straub (1989), Cronbach's Alpha levels of 0.7 and above have been reported to indicate strong reliability for the constructs. The Cronbach's Alpha analysis indicated that all items supported the

reliability of all factors. Furthermore, the Cronbach's Alpha of each factor was 0.901 or higher, indicating very high reliability. Table 9 provides the outcome of this analysis.

Table 9. Cronbach's Alpha Reliability Analysis

Team Formation	No. of Items	Cronbach's Alpha
Task Performance (TP)	5	0.969
Team Cohesiveness (TC)	4	0.901
Social Bond (SB)	6	0.943
Computing Skills (CS)	5	0.934

A one-way analysis of variance (ANOVA) and a one-way analysis of covariance (ANCOVA) was used to analyze the hypotheses. The study used ANOVA to analyze H1, H2, H3, and H4. Table 10 provides an overview of the whole study results, including the mean square scores of the constructs for the groups along with the ANOVA results. Figure 3 presents the means and standard deviations of the aggregated composite score. Calculating the means squares for every construct between groups and within groups SPSS obtained a significance of the F ratio or *p* value for TC was 0.224 that tells that there is no significance difference between groups. For SB, the significance of the F ratio or p value was 0.121. This also tells that there is no significance difference between groups but also tells that additional research with this construct will be needed. TP also does not have a significance difference between groups. The significance of the F ratio or *p* value was 0.740. Finally, for CS SPSS obtained a significance of the F ratio or *p* value of 0.039. This construct has a significance difference.

Table 10. ANOVA Results for Team Formation

Constructs	ANOVA			
	Mean Square between groups	F	Sig.	
TC	3.496	1.511	0.224	
SB	4.100	2.146	0.121	
TP	0.659	0.302	0.740	
CS	5.545	3.329	0.039	*

* - p<0.05, ** - p<0.01, *** - p<0.001

Looking at all constructs and their results, this study determines that the construct of Computing Skills (CS) has the most significance difference, compared to the other ones. CS has the lower values for the items, compared to the other constructs.

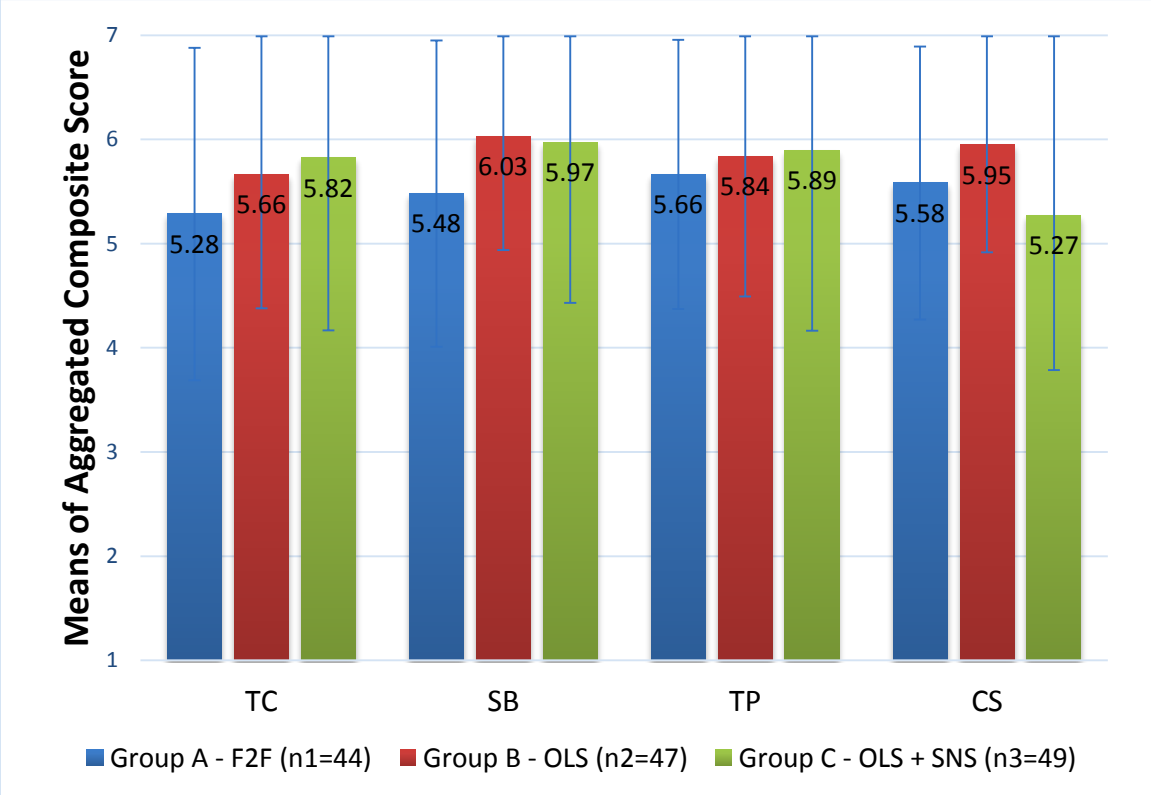

Figure 3. Means and Standard Deviations of Aggregated Composite Score (TC, SB, TP & CS)

A one-way analysis of covariance (ANCOVA) was used to analyze H5. According to Mertler and Vannatta (2013), "ANCOVA is similar to one-way analysis of variance (ANOVA) in that two or more groups are being compared on the mean of some dependent variable, but ANCOVA additionally controls for a variable (covariate) that may influence the dependent variable" (p. 15). Looking at the results of the analysis, it was determined that gender was significance when compared with the other ones using TP Means as the dependent variable with a *p* value of 0.039. Noticed that because education had a *p* value of 0.103 with TP Means as the dependent variable, more research can be done in this area. Also, Academic Major using CS Means as the dependent variable was the most significance covariate when compared with the other ones, with a *p* value of 0.002. Education and Academic Year using CS Means as the dependent variable were significance also with a *p* value of 0.034 and *p* value of 0.016 respectively. Table 11 provides the outcome of the ANCOVA analysis.

Table 11. ANCOVA results for demographic information

	ANCOVA								
	TP Means (DV)			**TC Means (DV)**		**CS Means (DV)**			**SB Means (DV)**	
Demographics	**F**	**Sig.**		**F**	**Sig.**	**F**	**Sig.**		**F**	**Sig.**
Gender	4.755	**0.039**	*	0.821	0.373	0.005	0.945		0.089	0.768
Age	0.080	0.780		0.479	0.495	0.189	0.666		0.696	0.411
Education	2.859	0.103		0.048	0.828	4.826	**0.034**	*	0.336	0.567
Academic Major	0.187	0.669		0.567	0.458	10.918	**0.002**	**	0.320	0.576
Academic Year	2.253	0.146		0.905	0.350	6.329	**0.016**	*	0.323	0.574

* - p<0.05, ** - p<0.01, *** - p<0.001

In Figure 4 presents the means and standard deviations of gender. Figure 5 represents the means and standard deviations of age. Figure 6 is the representation of education with the same statistics and Figure 7 represents academic program for the means and standard deviations. Finally, Figure 8 represents the academic year.

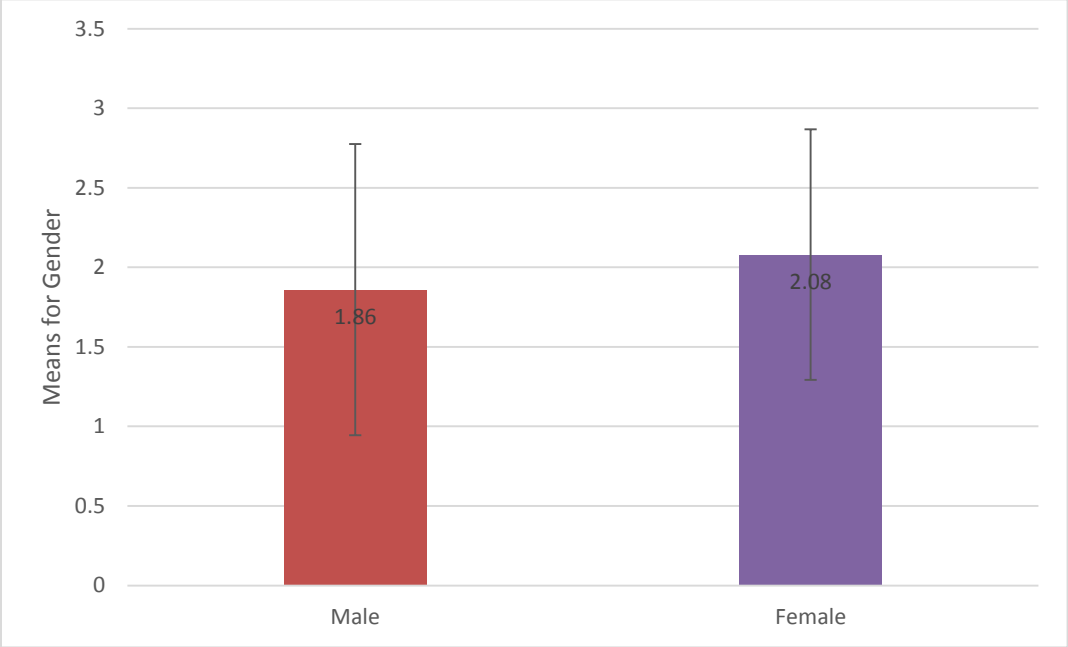

Figure 4. Means and Standard Deviations based on Gender (Male=29, Female=111)

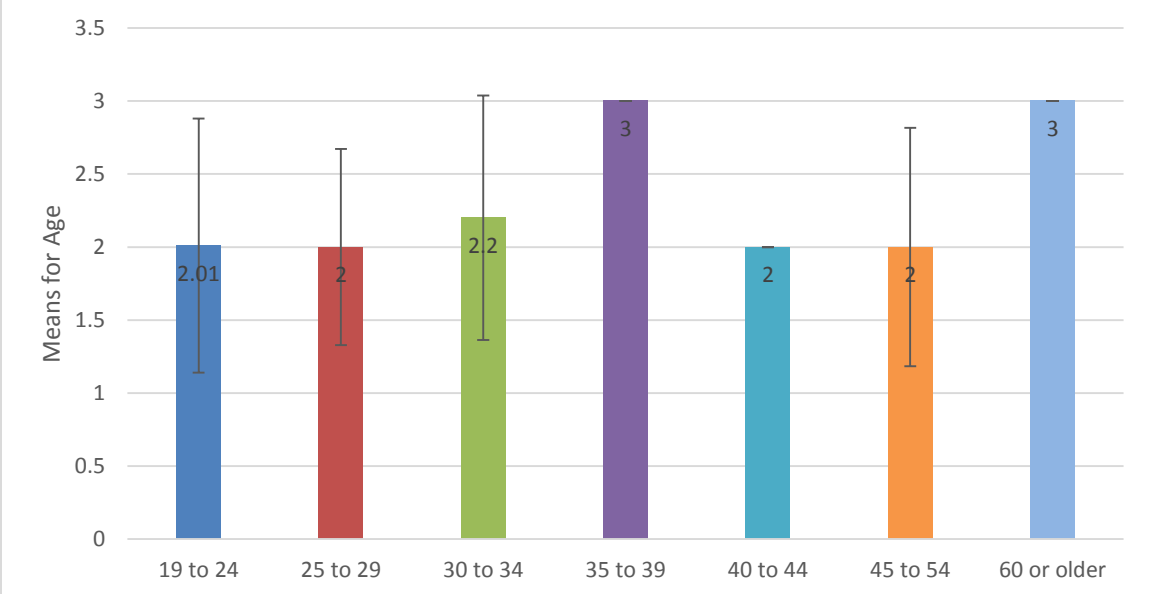

Figure 5. Means and Standard Deviations based on Age (19 to 24=95, 25 to 29=32, 30 to 34=5, 35 to 39=2, 40 to 44=1, 45 to 54=4, 60 or older=1)

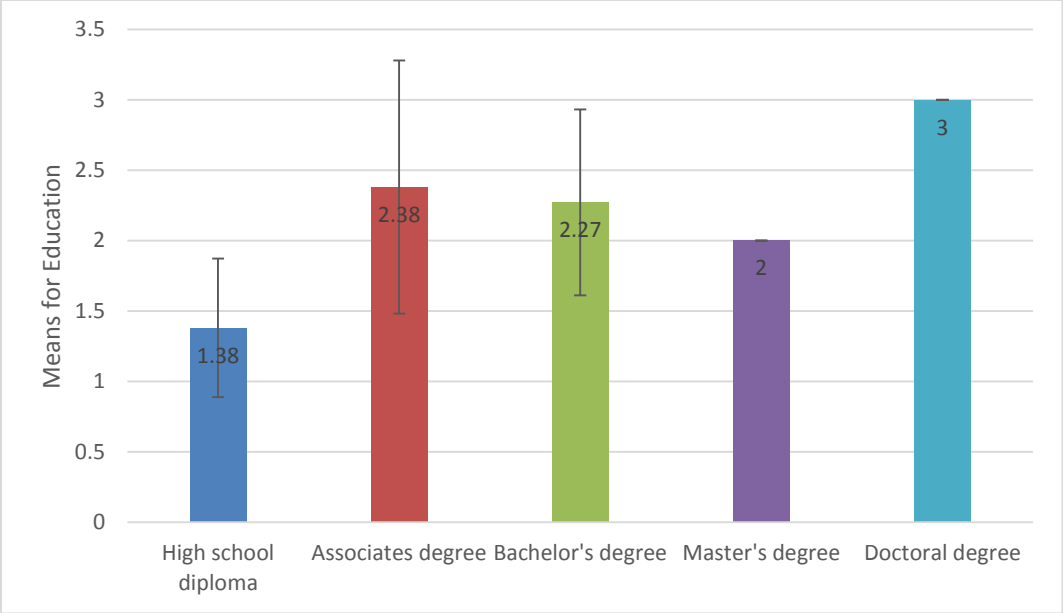

Figure 6. Means and Standard Deviations based on Education (High School Diploma=42, Associates degree=47, Bachelor's degree=44, Master's degree=6, Doctoral degree=1)

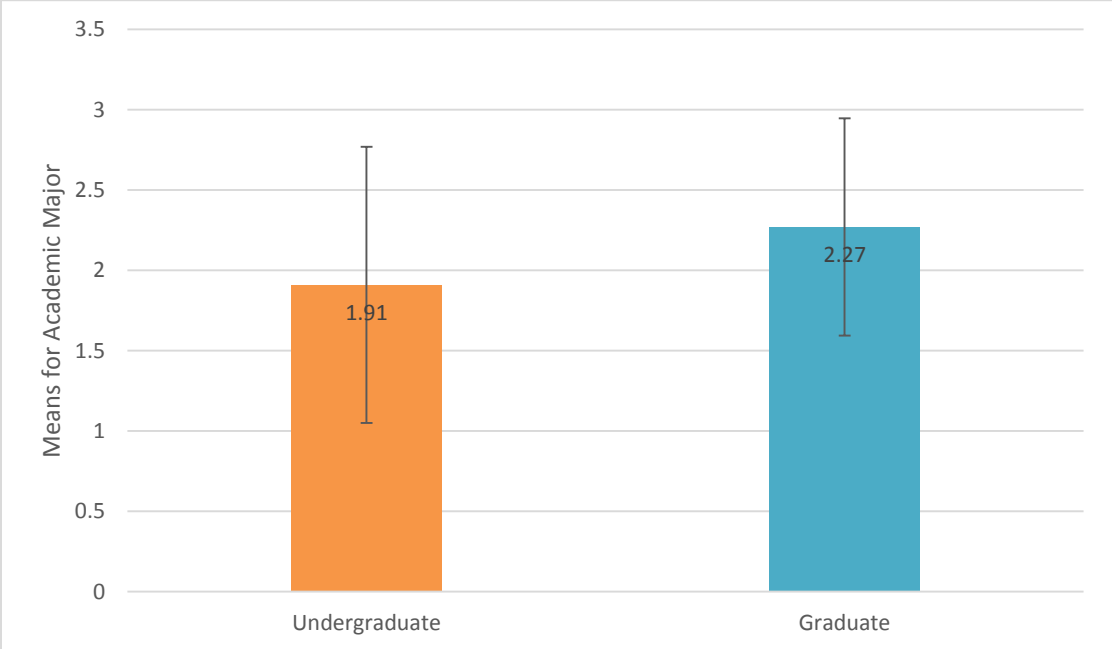

Figure 7. Means and Standard Deviations based on Academic Major (Undergraduate=92, Graduate=48)

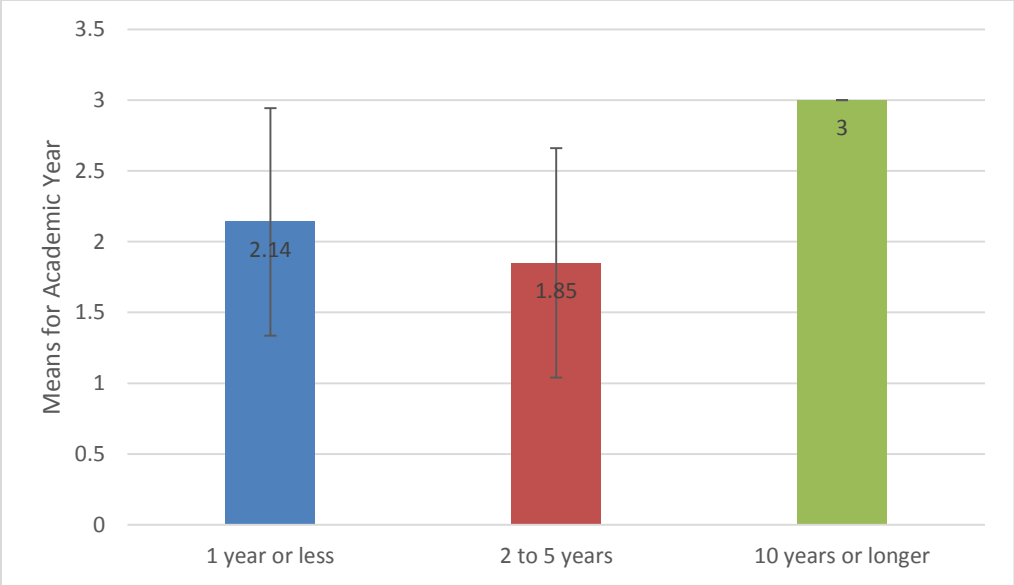

Figure 8. Means and Standard Deviations based on Academic Year (1 year or less=85, 2 to 5 years=54, 10 years or longer=1)

Findings

The results of the tests of the hypotheses are summarized in table 12.

Table 12. Summary of Hypotheses Results

Hypotheses	Results
H1: There will be no significant difference in the role of CMC levels employed *(No CMC/F2F, OLS, OLS+SNS)* on the level of *TP* in team formation.	Fail to reject
H2: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *cohesion* in team formation.	Fail to reject
H3: There will be no significant difference in the role of CMC levels employed *(No CMC/F2F, OLS, OLS+SNS)* on the level of perception of *SB* in team formation.	Fail to reject

Table 12. Summary of Hypotheses Results

Hypotheses	Results
H4: There will be no significant difference in the role of CMC levels employed *(No CMC/F2F, OLS, OLS+SNS)* on the level of perception of *CS* in team formation.	Rejected
H5a: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *gender*.	Partially Rejected (For TP construct rejected. For cohesion, SB and CS construct, not rejected)
H5b: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *age*.	Fail to reject
H5c: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *education level*.	Partially Rejected (For CS construct rejected. For cohesion, SB and TP construct, not rejected)
H5d: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic major*.	Partially Rejected (For CS construct rejected. For cohesion, SB and TP construct, not rejected)

Table 12. Summary of Hypotheses Results

Hypotheses	Results
H5e: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic year*.	Partially Rejected (For CS construct rejected. For cohesion, SB and TP construct, not rejected)

Summary

This chapter outlined the approach and research methodology necessary to achieve the research goals of the study. The chapter presents the results and the analysis of them in order to reject or fail to reject the hypotheses. The analysis started with a pre-analysis of the data for a screening data purpose. The screening data resulted in the elimination of three cases resulting in a 140 usable cases and three deleted items (TC1, TC3 and SB1) of the survey instrument. A Mahalanobis distance was made to identify multivariate outliers. The results showed that there were not any outliers identified and considered for removal prior to full analyses.

A demographic analysis was made to examine more information about our population. The results presented an analysis of which 111 or 79.3% were completed by females and 29 or 20.7% were completed by males. Analysis of the ages of respondents indicated that 127 or 90.8% were between 19 to 29. Respondents with associates degrees are 33.6% of the population while bachelor's degrees are 31.4%. Overall, 98 respondents or 70% had a university degree prior studying in the program that they have enrolled in the School of Health Professions, 92 or 65.7% were enrolled in an undergraduate

program and 85 or 60.7% had one year or less in the program that they have enrolled. Details of the demographics of the population are presented in table 6.

Three groups were compared: Group A, Group B, and Group C. Group A included individuals from an on-campus course, forming groups F2F in class to work on some tasks and acted as the control group for this proposed research. Group B included individuals from an OLS, forming groups assigned by the professor in virtual teams using a traditional discussion board online to work on the same tasks in the system. Group C included individuals from an OLS, forming groups in virtual teams using SNS to work on the same tasks in the system using a discussion board provided by the OLS. Details of the demographics of the population of each group are presented in table 7.

Cronbach's Alpha was used to assess the reliability of each of the measured constructs. The Cronbach Alpha analysis indicated that all items supported the reliability of all factors. Furthermore, the Cronbach's Alpha of each factor was 0.901 or higher, indicating very high reliability.

This study performed ANOVA to analyze H1, H2, H3 and H4. The only construct to have a significant difference was CS with a $p<0.05$. For H5 the study performed ANCOVA for the analysis. Looking at the results of the analysis, it was determined that gender was significance when compared with the other ones using TP Means as the dependent variable with a *p* value of 0.039. Noticed that because education had a *p* value of 0.103 with TP Means as the dependent variable, more research can be done in this area. Also, Academic Major using CS Means as the dependent variable was the most significance covariate when compared with the other ones, with a *p* value of 0.002. Education and Academic Year using CS Means as the dependent variable were

significance also with a *p* value of 0.034 and *p* value of 0.016 respectively. Table 12 shows a summary of the rejected hypotheses and the fail to reject ones.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Conclusions

The main goal of this research study was to assess the role of different CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance (TP), team cohesiveness (TC), social bond (SB) and computing skills (CS), while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year. The study included a conceptual model for team formation success (figure 1) and proposed five hypotheses. The five specific research hypotheses addressed were:

H1: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of *TP* in team formation.

H2: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *cohesion* in team formation.

H3: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *SB* in team formation.

H4: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *CS* in team formation.

H5: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the success of team formation as measured by the

levels of *TP*, perception of cohesion, perception of *SB* and perception of *CS* when controlled for demographic information such as *gender*, *age*, *education level*, *academic major*, as well as *academic year*.

More specifically:

H5a: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *gender*.

H5b: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *age*.

H5c: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *education level*.

H5d: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic major*.

H5e: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB,* and perception of *CS* when controlled for *academic year*.

A survey instrument was used to assess the research goal. The proposed research study used a one-way analysis of variance (ANOVA) to analyze H1, H2 H3 and H4. A one-way analysis of covariance (ANCOVA) was used to analyze H5. In the case of this

research study $p<0.05$, $p<0.01$ and $p< 0.001$, was used as a threshold to reject the null hypotheses, thus, indicating statistical significance among the groups.

Discussion

Overall, the results indicated that there is a significance difference in the role of CMC levels employed (No CMC/F2F, OLS, OLS+SNS) on the level of self-reported of CS within team formation. Also, there is a significance difference in the role of CMC levels employed (No-CMC/F2F, OLS, & OLS+SNS) on the levels of TP, when controlled for gender. In addition, there is a significance difference in the role of CMC levels employed (No-CMS/F2F, OLS, & OLS+SNS) on the levels of CS, when controlled for education, academic major and academic year.

The results showed that the construct of CS can help in the formation of virtual teams. The variables of education, academic major and academic year are also important in the formation of these teams in the virtual environments and have to be considered in the formation. The most interesting finding that this study present is that basically it did not really have a major significance difference between the groups. Originally, the study assumes that TC, SB, TP and CS will have significance difference between the groups. In the end, the study did not get that. It is possible that students in Group A (No CMC/F2F) were using mobile devices to communicate between them and the study did not consider this.

This current study compared with other studies like the work of Joe, Tsai, Lin, and Liu (2014) that they used TP as one of the construct in their model to measure team

performance to determine the success of team formation. As with any research study, this study also had some limitations that will be raised in the following sections.

Implications

This research study has some implications for the existing body of knowledge in the area of team formation and virtual teams. Organizations are continuing to use the Internet as a source to team formation in virtual environments. The results of this study contributed to the body of knowledge for both practice and research, to help organizations identify ways to support effective team formations.

Study Limitations

As with any research, this study had some limitations. One of the main significant limitation of this study was the generalizability of the sample. The collected data was limited to an educational environment, so generalizability to a work setting may be limited as well. The university where the study was conducted had limited participants because the instrument to collect the data uses only students taking online classes offered by the School of Health Professions. Therefore, the total population size is limited; it was not limiting the size enough to preclude the study. Another limitation is the CMC that were used. In the future, other CMC can be developed and other SNS can arise and be used by more people than the Facebook platform that was used in this study.

Recommendations and Future Research

This research study outlined a conceptual model for team formation success. Because all the null hypotheses were not rejected, future research is needed to investigate the construct of TC, SB and TP. Particularly SB that had an F ratio of 0.121, this indicate that more research is needed to evaluate this particular construct. Probably, future research can try other studies with other types of population. Also, future studies are warranted to increase the validity of the instrument. In addition, more research will be needed to expand the sample size and the use of other organizations to increase the generalizability. While this research study concentrated on an educational organization, future research could include assessing other organizations and industries.

Summary

This research study addressed the difficulty of team formation and collaboration between individuals in virtual teams (Agustín-Blas et al., 2011; Anagnostopoulos, Becchetti, Castillo, Gionis, & Leonardi, 2012; Fransen, Kirschner, & Erkens, 2011; Liccardi et al., 2007; Malhotra, Majchrzak, & Rosen, 2007; Ounnas, 2008). The main goal of this research study was to assess the role of different CMC levels employed (No-CMC/F2F, OLS, OLS+SNS) on the success of team formation as measured by the level of task performance (TP), team cohesiveness (TC), social bond (SB) and computing skills (CS), while assessing if there are any differences on such relationships when controlled for demographic information such as gender, age, education level, academic major, as well as academic year. The study made a conceptual model for team formation success

(figure 1) and proposed five hypotheses. The five specific research hypotheses addressed were:

H1: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of *TP* in team formation.

H2: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *cohesion* in team formation.

H3: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *SB* in team formation.

H4: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the level of perception of *CS* in team formation.

H5: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the success of team formation as measured by the levels of *TP*, perception of cohesion, perception of *SB* and perception of *CS* when controlled for demographic information such as *gender*, *age*, *education level*, *academic major*, as well as *academic year*.

More specifically:

H5a: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *gender*.

H5b: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *age*.

H5c: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *education level*.

H5d: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic major*.

H5e: There will be no significant difference in the role of CMC levels employed *(No-CMC/F2F, OLS, OLS+SNS)* on the levels of *TP*, perception of *cohesion*, perception of *SB*, and perception of *CS* when controlled for *academic year*.

A survey instrument was used to assess the research goal. The proposed research study used a one-way analysis of variance (ANOVA) to analyze H1, H2 H3 and H4. A one-way analysis of covariance (ANCOVA) was used to analyze H5. In the case of this research study, alpha levels, $p<0.05$, $p<0.01$ and $p< 0.001$, were used as thresholds to reject the null hypotheses, thus, indicating statistical significance among the groups. This research study compared three groups: Group A, Group B, and Group C. Group A included individuals from an on-campus course, forming groups F2F in class to work on some tasks and acted as the control group for this proposed research. Group B included individuals from an OLS, forming groups assigned by the professor in virtual teams using a traditional discussion board online to work on the same tasks in the system. Group C included individuals from an OLS, forming groups in virtual teams using SNS to work on the same tasks in the system using a discussion board provided by the OLS. The results presented an analysis of which 111 or 79.3% were completed by females and 29 or 20.7% were completed by males. Analysis of the ages of respondents indicated that 127

or 90.8% were between 19 to 29. Respondents with associates degrees are 33.6% of the population while bachelor's degrees are 31.4%. Overall, 98 respondents or 70% had a university degree prior studying in the program that they have enrolled in the School of Health Professions, 92 or 65.7% were enrolled in an undergraduate program and 85 or 60.7% had one year or less in the program that they have enrolled. Details of the demographics of the population are presented in Table 6. This research study used Cronbach's Alpha to assess the reliability of each of the measured constructs. The Cronbach Alpha analysis indicated that all items supported the reliability of all factors. Furthermore, the Cronbach's Alpha of each factor was 0.901 or higher, indicating very high reliability. This study performed ANOVA to analyze H1, H2, H3 and H4. The only construct to have a significant difference was CS with a $p<0.05$. For H5 the study performed ANCOVA for the analysis. One of the control variable that shows a significance difference was Gender with a $p<0.05$ when using TP Means as the dependent variable. Also Education, Academic Major and Academic Year shows a significance difference with a $p<0.05$ when using CS Means as the dependent variable. Table 12 shows a summary of the rejected hypotheses and the fail to reject ones.

In conclusion, other research studies could use the survey instrument to assess new populations and complete the needed research with the construct of TC, SB and TP. Researching other populations could provide better data to improve the conceptual model.

Appendix A

Survey Instrument

General Instructions

Dear Participant:

As a PhD student at Nova Southeastern University, I am conducting research for my dissertation that will investigate the success of group formation in virtual teams using social networking sites. My co-investigator and mentor for this study is Dr. Yair Levy, a Professor at Nova Southeastern University.

I would appreciate your participation in this research survey. The survey is divided into five sections and will take approximately 15 minutes to complete. Please note that all the questions are required to be answered, so you are asked to complete all the questions in each section before you can submit the survey. All information gathered during this study will be protected and will be anonymous.

If you have any questions, you can contact me at 787-379-9586 or email me at melon@nova.edu. Thank you for your time and your participation in this survey.

To start the survey, click on the following link (the link will be placed here).

Sincerely,

Eliel Melón, PhD Candidate

Nova Southeastern University

Section 1. Team Cohesiveness (TC)

Please rate how you perceive your integration in the team. How do you perceive the cohesion of your team? Please mark your answer using the scale from (1) Strongly Disagree to (7) Strongly Agree.

Item								
TC1	I feel that I belong to this team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
TC2	I am happy to be part of this team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
TC3	If a member of my team tries to leave, I will dissuade him or her.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
TC4	This team is one of the best.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
TC5	I think the tasks are very important when working on them with my team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
TC6	I feel that I would like to participate in other tasks like this one, if I will have the same members as a team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)

Section 2. Social Bond (SB)

Please rate how you perceive your connection with others in the team. How do you perceive the connection with others in your team? Please mark your answer using the scale from (1) Strongly Disagree to (7) Strongly Agree.

Item								
SB1	I am very attached to all the members of my team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB2	I am very committed to my team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB3	I am very involved with my team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB4	I believe that every member of our team is important.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB5	I encourage every member to participate in the governance of the team.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB6	I am involved in the participation of the team when doing the tasks assigned to us.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)
SB7	I encourage other members of my team to work on our tasks.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewhat agree (5)	Agree (6)	Strongly Agree (7)

Section 3. Task Performance (TP)

Please rate how you perceive your performance with others in your team. How do you perceive the performance in your team? Please mark your answer using the scale from (1) Strongly Disagree to (7) Strongly Agree.

Item								
TP1	The team gets the job tasks done.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
TP2	The team demonstrates effectiveness in accomplishing major work goals.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
TP3	The team strives for quality in the tasks.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
TP4	The team handles multiple task demands and priorities effectively.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
TP5	The team fulfills all technical responsibilities required for the job.	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)

Section 4. Computing Skills (CS)

Please rate how you consider yourself in terms of computing skills. Do you have knowledge in computer hardware and software? Please mark your answer using the scale from (1) Strongly Disagree to (7) Strongly Agree.

Item								
CS1	Knowledge and use of hardware?	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
CS2	Knowledge and use of Internet browsers?	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
CS3	Knowledge and use of operating systems?	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
CS4	Knowledge and use of social networking sites?	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)
CS5	Experience in using application software?	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree or disagree (4)	Somewh at agree (5)	Agree (6)	Strongly Agree (7)

Section 5. Demographic Information

1. What is your gender?
    a. Male
    b. Female

2. What is your age group?
    a. 18 or under
    b. 19 to 24
    c. 25 to 29
    d. 30 to 34
    e. 35 to 39
    f. 40 to 44
    g. 45 to 54
    h. 55 to 59
    i. 60 or older

3. What is your highest educational degree attained?
    a. High school diploma
    b. Associates degree
    c. Bachelor's degree
    d. Master's degree
    e. Professional degree
    f. Doctoral degree

4. At this moment, in what program are you enrolled in the Medical Science's Campus?
    a. Undergraduate
    b. Graduate

5. How long have you been in your program of study?
    a. 1 year or less
    b. 2 to 5 years
    c. 6 to 9 years
    d. 10 years or longer

Appendix B

Nova IRB Approval

NOVA SOUTHEASTERN UNIVERSITY
Office of Grants and Contracts
Institutional Review Board

MEMORANDUM

To: Eliel Melon-Ramos

From: Ling Wang, Ph.D.
Institutional Review Board

Date: May 20, 2014

Re: *A Study of the Success of Group Formation in Virtual Teams Using Computer Mediated Communications*

IRB Approval Number: wang04151403

I have reviewed the above-referenced research protocol at the center level. Based on the information provided, I have determined that this study is exempt from further IRB review. You may proceed with your study as described to the IRB. As principal investigator, you must adhere to the following requirements:

1) CONSENT: If recruitment procedures include consent forms these must be obtained in such a manner that they are clearly understood by the subjects and the process affords subjects the opportunity to ask questions, obtain detailed answers from those directly involved in the research, and have sufficient time to consider their participation after they have been provided this information. The subjects must be given a copy of the signed consent document, and a copy must be placed in a secure file separate from de-identified participant information. Record of informed consent must be retained for a minimum of three years from the conclusion of the study.

2) ADVERSE REACTIONS: The principal investigator is required to notify the IRB chair and me (954-262-5369 and 954-262-2020 respectively) of any adverse reactions or unanticipated events that may develop as a result of this study. Reactions or events may include, but are not limited to, injury, depression as a result of participation in the study, life-threatening situation, death, or loss of confidentiality/anonymity of subject. Approval may be withdrawn if the problem is serious.

3) AMENDMENTS: Any changes in the study (e.g., procedures, number or types of subjects, consent forms, investigators, etc.) must be approved by the IRB prior to implementation. Please be advised that changes in a study may require further review depending on the nature of the change. Please contact me with any questions regarding amendments or changes to your study.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Protocol File

03301 College Avenue • Fort Lauderdale, FL 33314-7796 • (954) 262-5369
Fax: (954) 262-3977 • Email: *inga@nsu.nova.edu* • Web site: www.nova.edu/cwis/ogc

Appendix C

Letter of Approval of the Dean of the School of Health Professions

Escuela de Profesiones de la Salud
Recinto de Ciencias Médicas • UPR

School of Health Professions
Medical Sciences Campus • UPR

24 de septiembre de 2014

Human Research Subjects Protection Office
Universidad de Puerto Rico
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Rubén García García, Ph.D.
Decano Interino
Escuela de Profesiones de la Salud

Carta de Endoso al Sr. Eliel Melón Ramos para realizar investigación con estudiantes de la Escuela de Profesiones de la Salud

El Sr. Eliel Melón Ramos, Director Interino de la Oficina de Informática y Recursos Educativos de la Escuela de Profesiones de la Salud, se encuentra realizando estudios doctorales en *Nova Southeastern University* para obtener un Ph.D. en Ciencias de Computadoras y Sistemas de Información. Como parte de los requisitos para la obtención de dicho grado, necesita realizar una investigación científica cuyo nombre en inglés es, *A Study of the Success of Group Formation in Virtual Teams Using Computer-Mediated Communications.* A estos efectos, el señor Melón Ramos junto a su mentor, el Dr. Yair Levy, han decidido realizar su investigación utilizando los estudiantes de la Escuela de Profesiones de la Salud como los sujetos.

En dicha investigación se propone evaluar el papel de los diferentes niveles de comunicación, mediados por ordenadores para formar equipos y determinar el éxito de dichas formaciones, midiendo el nivel de ejecución de las tareas a realizar, la cohesión de los equipos y los lazos sociales de sus miembros, mientras se evalúa además, si existe alguna diferencia en este tipo de relaciones cuando se controlan datos demográficos como el sexo, edad, nivel de educación y especialización académica.

El señor Melón Ramos cuenta con todo el apoyo de este servidor para realizar la misma en la Escuela de Profesiones de la Salud. De necesitar información adicional, estamos a sus órdenes.

Muchas gracias.

¡Diecisiete Programas, una sola Escuela!
Escuela de Profesiones de la Salud

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