A SYSTEMATIC LITERATURE REVIEW TO IDENTIFY BEST PRACTICES FOR COMMUNICATION IN VIRTUAL TEAMS

by

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To everyone who has believed in my ability to succeed and helped me to do so.
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ABSTRACT

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Virtual teams are necessary for organizations to remain competitive in today’s global society, but the complexities of virtual team environments impart strain on virtual teams to perform key team activities. Although virtual teams are expected to deliver complex projects, training for communicating in virtual teams is often overlooked. This thesis was conducted using a systematic literature review of peer-reviewed articles from 2012-2017 to identify elements of communication that contributed to virtual team effectiveness and communication best practices that may be perceived as prescriptive content for virtual team communication training. The results of this study suggest that virtual team communication training should include best practices related to: (a) communication structures, (b) communication channels, (c) characteristics of emergent leader communication, and (d) culture and communication.
CHAPTER 1. INTRODUCTION

From early on, young children are taught how to behave in traditional face-to-face teams, with people that they see often and whose mannerisms they can observe. For organizations all over the globe traditional face-to-face teams are disappearing. The room where everyone once physically gathered and talked and observed visual cues of one another is empty, as collaboration is occurring virtually, using technology-mediated communication tools to complete tasks across time and distance. The manner in which things are done has changed, however the ways people are taught to interact remains the same.

The following section of this thesis addresses the gap in pedagogical practice that exists in virtual teams. Specifically, the research questions are posed, the scope of the investigation is presented, followed by assumptions, limitations, delimitations, as well as the definitions of key terms that are significant to the research.

1.1 Statement of the Problem

According to Graham, Daniel, and Doore (2016) management theories taught in many business schools are rooted in the United States’ industrial age. Although members of today’s society commonly interact via text messages, video conferencing such as Facetime and other communication technologies, we do so in social aspects without a second thought. The use of virtual communication technology has expanded in organizations with little consideration to just how valuable these modes of communication can be. While, team members are primarily taught in co-located teamwork environments, and although these employees have the technical skills to complete the tasks, they become employees who are not socially prepared to work professionally in virtual teams (Graham et al., 2016). Virtual teams are not only utilized by teams in industry,
but also by government, military, healthcare, and non-for-profit organizations. Therefore, it is imperative that 21st century team members know how to work efficiently in virtual environments. Success in a virtual environment requires different knowledge, skills, and abilities (Schulze, Schultze, West, & Krumm, 2017; Cascio, 2000) as virtual team members needed to be able to proactively build social structure and form collective team and knowledge sharing practices (Rosen, Furst, & Blackburn, 2006). Yet a small number of universities or organizations offer training for virtual teamwork (Brewer, Mitchell, Sanders, Wallace, & Wood, 2015).

1.2 Significance

In a 2016 global business survey of 1,372 respondents from 80 countries, 85% of the team members indicated they worked on virtual teams (RW³ CultureWizard, 2016). Many university students learn the importance of body language and vocal tone in communication, yet in today’s world of technology-mediated communication, such social cues are not so easily displayed once graduates transition into working roles where virtual teams are commonplace. Empirical evidence suggested that virtual teams require different approaches to leadership, information sharing, and communication than working in face-to-face teams (Bell & Kozlowski, 2002; Hoch & Kozlowski, 2014) as virtual teams are plagued by lesser team engagement and have a harder time developing trust and shared understanding among team members (Dulebohn & Hoch, 2017). Completing tasks in virtual teams presents a different set of challenges and in many cases virtual teams are considered inferior to face-to-face teams (Hertel, Geister, Konradt, 2005).

Onboarding programs for internships and full-time employment, which often require working in high degrees of virtuality, have failed to train on the differences of working in virtual vs. face-to-face teams. Many technical and communication professionals have expressed they have


received inadequate training to prepare them to function well on virtual teams, while only 22% of 1372 respondents indicated they partook in virtual team training (RW3 CultureWizard, 2016). To make matters worse, “virtual teams are often assigned the most important tasks in an organization, such as multinational product launches, negotiating mergers and acquisitions, and strategic alliances” (Pauleen, 2003, p. 228), so failure is costly. Empirical research revealed that poor virtual teamwork strategies are responsible for the failure of almost 50% of outsourced business relations (Lenz & Machado, 2008).

The motivation for this study was twofold: the author wanted to aid in promoting the value of virtual communication training and contribute to bridging the gap between academic and practice. The author argues that motivation, trust and other team processes are communicatively constructed. Communication was chosen as the focus of this study as it is the means through which team members share information, and that is momentous to the successful execution of projects (Pinto & Pinto, 1990).

1.3 Research Questions

This thesis was conducted to determine:

1. What elements of communication contribute to virtual team effectiveness?

2. What best practices for communication should be included in virtual team training?

1.4 Purpose of Study

The purpose of this study was to conduct a systematic literature review to identify what communication practices enable virtual team effectiveness. This study aimed to play a role in understanding why virtual communication is overlooked in professional training, aid in promoting
the value of virtual communication training, and contribute to bridging the gap between academia and practice.

1.5 Scope

Although knowledge of other processes can be valuable to new virtual team members, this study focused on virtual team communication processes and the elements and patterns of effective virtual team communication. There is a large pool of virtual team studies; this study was limited to analyzing qualified studies that examined the influence of virtual communication patterns on team processes.

1.6 Assumptions, Limitations, Delimitations

The following assumption were made for this thesis:

- Although virtuality can sometimes take place in team that are co-located, this study will assume that team members are geographically dispersed and hardly, if ever, meet face-to-face, as the absence of physical presence is an important distinguishing characteristic of virtual teams from traditional face-to-face teams (Bell & Kozlowski, 2002).

The limitations of this study are:

- This study will only covered published work, which may have resulted in publication bias as there is a tendency in published work to only include results of statistical significance (Rosenthal, 1979).
- A sole researcher conducted this review; systematic literature reviews are typically carried out by more than one researcher.

The delimitations of this study are:
• This study did not make global virtual team communication a primary focus, although much of the literature that did focus on virtual team communication included a focus on global teams and cultural barriers.

• The outcome of this study intends to serve trainers of virtual teams.

1.7 Definitions

Communication - “The process of transmitting information and common understanding from one person to another” (Lunenburg, 2010, p. 1)

Effective communication – “A two-way information sharing process which involves one party sending a message that is easily understood by the receiving party” (Effective communication, 2017, p. 1).

Team – “A distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, and who each have some specific roles or functions to perform” (Salas, Dickinson, Converse, & Tannenbaum, 1992, p. 4).

Team effectiveness – The viability and performance of the team.

• Viability – “Team member’s satisfaction, participation, and willingness to continue working together” (Sundstrom, De Meuse, and Futrell, 1990, p. 122).

• Performance – “Acceptability of output to customers within or outside the organization who receive team products, services, information, decisions, or performance events” (Sundstrom et al., 1990, p. 122).

Transformational leadership – A leadership style that aims to encourage followers to achieve
exceptional performance by use of “charisma, inspirational motivation, intellectual stimulation, and individualized consideration behaviors” (Purvanova & Bono, 2009, p. 344).

Virtuality – How a team operates based on the comparative amount of electronic communication, their geographical distribution, and their use of asynchronous and synchronous communication (Hoch & Kozlowski, 2014, p. 391).

Virtual teams – “Groups of people working interdependently to achieve a common task or goal communicating through electronic means, which may be email, web-based communication, video and/or audio, but in general having considerable interaction online” (Warkentin & Beranek, 1999, p. 271).

1.8 Summary

This chapter discusses the importance of conducting a systematic literature review to identify best practices for communication in virtual teams. The research question is posed along with the assumptions, limitations, and delimitations in effort to limit the scope of the research investigation.
CHAPTER 2. REVIEW OF LITERATURE

2.1 Introduction

The use of virtual tools to connect workers has continued to increase (Alge, Wiethoff, & Klein, 2003; Brewer et al., 2015; Martins, Gilson, & Maynard, 2004). In the 21st century workplace, virtual teams are used in industry, government, military, healthcare, and non-for-profit organizations. Organizations use virtual teams because they provide many benefits in terms of financial savings, competencies and competitiveness. Although virtual teams have many advantages, they have many challenges as compared to traditional face-to-face teams, specifically when it comes to communication. When done ineffectively, communication using virtual communication tools leads to misunderstandings, misinterpretations, and delays.

Compared to the abundance of literature existing about virtual teams, only a small portion to this point has been dedicated to virtual team training and education in regards to effective communication (Leonard, Graham, & Bonacum, 2004; Warkentin & Beranek, 1999). One exception is Brewer (2015) which focuses on intercultural virtual team training. Although many virtual team studies utilized student subjects, there is a void of knowledge and studies related to training and educating students or employees to be prepared to communicate effectively in virtual teams.

The literature does show that many of the communication challenges faced by virtual teams can be mitigated through experience and training. Through this review of literature, it will be conveyed through studies and theory why it is more difficult to effectively communicate in virtual teams and why there is a need to incorporate more focus on training and education of virtual teams. It is believe that preparation will better contribute to the success of virtual teams.
2.2 Virtuality in Teams

It is important to first discuss the construct of virtuality; the degree to which teams function virtually based on their use of virtual communication tools, geographic dispersion, and asynchronous communication (Hoch & Kozlowski, 2014). In the 21st century workplace virtuality has become ubiquitous. Most literature related to virtual teams treat virtuality and virtual teams as the opposite of co-located, face-to-face teams (Bell & Kozlowski, 2002a). Most teams do not fall on opposite ends of the spectrum of operating fully face-to-face or fully through virtual tools. Literature studying virtual teams has shifted away from this one-dimensional view of virtual teams being categorized as a type of team opposite of face-to-face teams and instead acknowledge that most teams operate to some degree of virtuality (Bell & Kozlowski, 2002a; Kirkman & Mathieu, 2005; Martins et al., 2004).

Contrary to most descriptions of virtual teams where geographical dispersion is specified as an essential factor to define virtual teams, distance between team members is in fact not a prerequisite to virtual teaming, in many cases co-located teams operate with high degrees of virtuality as well (Gibson & Cohen, 2003; Kirkman & Mathieu, 2005; Schweitzer & Duxbury, 2010). There are few studies of virtual teams that have attempted to address the concept of virtuality and its multiple dimensions (Kirkman & Mathieu, 2005; Schweitzer & Duxbury, 2010). Kirkman and Mathieu (2005) argued that all virtual communication tools are not equivalent; the tools selected for virtual communication contribute to the degree of virtuality and there are three-dimensions that define team virtuality “(a) the extent to which team members use virtual tools to coordinate and execute team processes, (b) the amount of informational value provided by such tools, and (c) the synchronicity of team member virtual interaction” (p. 702). Schweitzer and
Duxbury’s (2010) study of 30 virtual teams working in Canada also supported a multidimensional approach to understanding virtuality.

The higher the degree of virtuality, the more complex it became to communicate, build relationships and complete tasks (Kirkman & Mathieu, 2005; Morley, Cormican, & Folan, 2015). Although the author agrees the construct of virtuality does not only apply to geographically dispersed teams and co-located teams work virtually, this thesis refers to virtuality assuming there is geographic dispersion of team members, where team members rely on communication technology for majority of the interaction to accomplish their tasks.

2.3 Virtual Teams

There are numerous benefits of virtual teams discussed throughout the literature, Walther and Bunz (2005) stated that “virtual teams have the potential to offer greater flexibility, responsiveness, and diversity of perspectives than traditional [teams] do” (p. 829). The reduction of geographic constraints in virtual teams allow organizations to recruit and maintain top talent and build diverse teams of high expertise (Bergiel, Bergiel, & Balsmeier, 2008; Kayworth & Leidner, 2000). This ability to pool global talent leads to improved decision-making (Martins et al., 2004) and problem-solving skills (Kayworth & Leidner, 2000), and ultimately, more competitive organizations. Virtual teams allow companies an inexpensive way to bring dispersed, cross-functional experts together (Martins et al., 2004). In many cases, virtual teams allow round-the-clock productivity by utilizing different time zones (Delbohn & Hoch, 2017).

The benefits to working in virtual teams are alluring, but the challenges are abundant, such as difficulty communicating and coordinating activities, feelings of isolation among team members, misunderstandings, and increased conflict (Hertel et al., 2005; Morley et al., 2015; Purvanova, 2014). While many of these challenges are also present in traditional face-to-face
teams, these challenges tend to be more pronounced in virtual teams and virtual teams face additional difficulties (Kayworth & Leidner, 2002). Technological, cultural and language barriers increase frustrations (Lockwood, 2015), and without daily face-to-face time, virtual teams lack opportunities to provide feedback quickly which amplify misunderstandings (Bal, Foster, Bal, & Foster, 2000). With the ability to create cross-functional teams of high expertise, virtual teams are solving some of companies’ most difficult, global problems. They are also taking on some of the most important projects (Pauleen, 2003) making misunderstandings very costly.

Perceived social loafing threatens the effectiveness of virtual teams as team interactions lack situational and contextual factors often leading to assuming the worst of team members (Walther & Bunz, 2005; Monzani, Ripoll, María, & Dick, 2014). The negative effects of perceived social loafing and misunderstandings are strong in teams that communicate with less rich media such as email and instant message where a slow response, or omission in a response can be interpreted as loafing (Monzani et al., 2014). Often virtual teams lack a collective identity, enhancing the negative effects of ineffective communication (Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011).

2.4 Effectiveness

Virtual teams are here to stay and organizations must adapt in order to grow and operate effectively. Virtual teams have fundamental differences from face-to-face teams and to be effective, virtual team members must adjust to “new types of work patterns, decision making styles, and relationships” (Alsharo, Gregg, & Ramirez, 2016, p. 479). Effectiveness is defined by Dictionary.com (2017) as “the degree to which something is successful in producing a desired result; success” (p. 1). As the bulk of literature avoided explicitly defining effectiveness, various
measurable outcomes were investigated as indicators of team effectiveness such as “communication, decision quality, productivity, and perceived quality” (Fjermestad, 2004).

Virtuality has impacted every organizational and situational context of Tannenbaum, Beard, and Salas’s (1992) input-throughput-output model of team effectiveness. Task, work, and team characteristics interact with technology factors to influence team outcomes (Lurey & Raisinghani, 2001). Kirkman and Mathieu (2005) suggested that future research investigate how team effectiveness is shaped by the communication technology choices made by virtual teams.

![Team Effectiveness Model](image)

**Figure 1.** Team Effectiveness Model (Tannenbaum et al., 1992).

Virtual team work arrangements are intricate, and effectiveness is constituted by sustainable habits (Gibson & Cohen, 2003) and “traditional team effectiveness factors may not apply or be less effective in a virtual team setting” (Alsharo, Gregg, & Ramirez, 2016, p. 479).
Gibson & Cohen (2003) contended that effectiveness occurred through various processes and it is unwise to look for single causal relationships between virtual teams and effectiveness, and the most practical approach to studying effectiveness was to ascertain the behaviors of leaders and managers that facilitated effectiveness among virtual team members.

2.5 Leadership and Culture in Virtual Teams

Leadership and cultural differences within virtual teams are important contextual factors to consider in team composition. Virtual team leaders are tasked with gaining buy-in from team members whom they rarely have face-to-face contact with, making an already difficult job harder to do. When virtual team members come from different cultural backgrounds, additional barriers challenge the effectiveness of teams (Kayworth & Leidner, 2002).

Literature on virtual teams examined the effects of participative and directive leadership (Kahai, Sosik, & Avolio, 2000), transformational leadership (Purvanova & Bono, 2009; Avolio, Kahai, & Dodge, 2001) and transactional leadership (Avolio et al., 2001). Transformational leadership style is recognized throughout the literature as effective among virtual teams, and found to be more impactful in virtual teams than face-to-face teams (Purvanova & Bono, 2009). Transformational leadership was linked to higher levels of effectiveness than transactional leadership (Avolio et al., 2001) and was found to reduce social loafing (Kahai et al., 2000).

Culture was described in different ways throughout the literature. Gibson and Gibbs (2006) defined culture as “characteristic ways of thinking, feeling, and behaving shared among members of an identifiable group” (p. 460). Independently from national culture, organizational culture also affected team functioning (Zakaria, Amelinckz, & Wilemon, 2004). Culture has been found to interact with various team processes to influence team outcomes (Connaughton & Shuffler, 2007). An important extrapolation from Connaughton and Shuffler’s (2007) review of culture in
multinational and multicultural teams is that cultural barriers may diminish in teams that “experience higher trust and regular communication” (p. 398).

2.6 Team Communication

2.6.1 Communication in teams

One of the hardest things for teams to do is cultivate effective communication patterns (Smart, Karl L. Barnum, 2000), that allow messages to be sent and received with shared understanding. Pinto’s (1990) study findings advocated a significant linkage between communication patterns and team accomplishment. Effective communication is a result of developing and maintaining personal relationships (Pauleen, 2014) and teams need effective communication to share the unique information necessary to solve significant problems (Alge et al., 2003). Communication as a process is prevalent in nearly every action of teams (Pinto & Pinto, 1990) and “it is imperative that we continue to improve our understanding of team functioning and team performance and continue to examine the usefulness of systematic interventions in team” (Tannenbaum, et al, 1992).

In the healthcare field, for instance, effective communication is monumental. Patient accidents most often occurred because of breakdowns in communication as doctors, nurses and other healthcare staff have different communication styles (Leonard et al., 2004). The use of clear communication tools and processes ensures effective communication among team members (Smart, Karl L. Barnum, 2000). In the Leonard et al., (2004) case study of an American healthcare system, the implantation of a consistent set of communication tools and behaviors helped bridge the gap in communication styles of staff. Smart and Barnum (2000) stated communication processes must be given the same attention as any other team process. Often, however, it has been assumed that working professionals inherently communicate effectively, and formal
Communication training is overlooked (Leonard et al., 2004). Communication is a critical success factor for any team, and its impact on virtual teams is momentous. Lenz and Machado (2008) professed that “every virtual team member should have proficiency and experience and possess a basic affinity towards modern communication technology” (p. 82).

2.6.2 Virtual team communication

Studies of virtual team communication have shown that face-to-face teams communicate more, and have an easier time coming to consensus than virtual teams (Fjermestad, 2004; Warkentin & Beranek, 1999b) due to the complexities under which virtual teams operate. Communicating across different time zones and across cultures through technology “may place a significant strain on the ability of team members to frame issues, achieve mutual levels of understanding, and to reach consensus on key decisions” (Kayworth & Leidner, 2000, p. 190). Virtual teams took longer to make decisions (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002; Fjermestad, 2004), and virtual teams were less satisfied than face-to-face teams (Baltes et al., 2002). Although virtuality increased the sharing of unique information, open information sharing was more pertinent to the performance of virtual teams (Mesmer-Magnus et al., 2011). The Mesmer-Magnus et al., (2011) meta-analysis showed a curvilinear relationship between virtuality and information sharing where high levels of virtuality deterred information sharing.

Virtual teams have been found to have inferior communication outcomes; less frequent communication, lower communication volume, and less efficient knowledge sharing than face-to-face teams (Purvanova, 2014). The laborious and asynchronous communication of highly virtual teams encouraged a lower volume of information sharing among team members and subsequently more confusion (Gibson & Cohen, 2003; Purvanova & Bono, 2009).
Virtual team communication was often depersonalized and more task focused (Freeman, 2017; Purvanova & Bono, 2009; Stephenson G. M. & Rutter, 1979) with virtual communication used as a tool to complete tasks and not to build relationships (Purvanova & Bono, 2009). Literature on virtual teams emphasized the importance of communicating socially (Monzani et al., 2014; Walther & Bunz, 2005; Zakaria, Amelinckx, & Wilemon, 2004). In the Flammia, Cleary, & Slattery (2010) study, teams that implemented both a task-focused and social-focused approach to communication had a higher level of satisfaction and trust with their teams. Virtual teams that put forth effort to communicate socially experienced higher participation and empowerment with the virtual team experience (Flammia et al., 2010)

Although they lack physical team presence, virtual teams also lacked the social norms, team pressures and hierarchical effects often prevalent in face-to-face teams. This allowed virtual team members to interact more freely and with more equal participation from all team members (Purvanova, 2014; Warkentin & Beranek, 1999a). Virtual teams shared more unique information with whom the information was most relevant to (Mesmer-Magnus et al., 2011). Although time differences and asynchronous communication can have negative impacts on team communication, they also allowed more time to consider requests and construct responses and feedback (Hertel et al., 2005; Mesmer-Magnus et al., 2011; Warkentin & Beranek, 1999a). The lack of pressure to formulate responses immediately in face-to-face meetings allowed for deeper information processing and more thorough, higher quality decision-making (Mesmer-Magnus et al., 2011).

### 2.6.3 Theory of virtual team communication

It is important to discuss the established theory behind why virtuality presents additional and more intense challenges to team communication.
Figure 2. Shannon-Weaver model of communication (Shannon & Weaver, 1949).

The Shannon and Weaver (1949) model of communication served as a foundational piece of communication theory and has been referred to as “the mother of all models.” Rooted in broadcast communication theory (Wagner, 1994), Shannon stated that the central problem with communication is getting the intended message to its destination (Shannon & Weaver, 1949). The Shannon-Weaver model has been adapted over the years by Schramm to include a feedback loop, and field of experiences to explicate that signals are understood in individual contexts (Wagner, 1994). These adaptations are presented in literature surrounding online learning and interactivity, as there is lack of models adapted for virtual team communication present in virtual team literature. The Shannon-Schramm communication model, extended from online learning, parallels virtual team member interaction and represents interaction as a constituent of effective communication (Wagner, 1994).
Shannon and Weaver (1949) also discussed the way noise affects information, and that an increase in one’s freedom of choice in selecting a message leads to an increase in the information communicated, thereby leads to an increase in the amount of uncertainty in an exchange. When communicating with virtual tools, there is greater freedom of choice when deciding how a message should travel to the receiver, leading to even more uncertainty.

Daft and Lengel (1986) argued that all organizations processed information under some degree of uncertainty and equivocality. When dealing with uncertainty, organizations understand they must gather more data or information to fill in the gaps of what they need to know to be successful. When dealing with equivocation, which Shannon refers to as “the entropy of the message relative to the signal” (Shannon & Weaver, 1949), the gaps are not so clear. Equivocality is ambiguity, and confusion about what is needed to be known. “Uncertainty is a measure of the organization’s ignorance of a value for a variable in a space. Equivocality is a measure of the organization’s ignorance of whether a variable exists in the space” (Daft & Lengel, 1986, p. 577).

There is a difference as most organizations deal with equivocal problems and equivocality is difficult to resolve through technology as it involves many conflicting explanations about the
issue at hand (Daft, Lengel, & Trevino, 1987). Therefore virtual teams are deemed inferior to face-to-face teams. When solving these ambiguous, unstructured problems, richer communication media was necessary; face-to-face communication being most rich. Proposed by Daft and Lengel, media richness theory identified media as high or low richness based on a media’s ability to communicate shared meaning and process information without distortion. Low richness referred to communication that takes place without physical presence; lacking social and visual cues such as body language and gestures.

What Daft and Lengel first proposed this theory, email was new to organizations and not widely used, and of course, at that time videoconferencing was not a viable option for virtual teams. Since the inception of the media richness theory, email use has become much more widely used and videoconferencing is now easily accessible. Although the use of richer media greatly improved team effectiveness, (Kayworth & Leidner, 2000), virtual teams still faced obstacles with related to communication (Kayworth & Leidner, 2002). Just like Daft and Lengel’s media richness continuum has been adapted to include the additions of video-conferencing, information, and email, the Shannon-Schramm model can be adapted to include additional noise sources that virtuality present (e.g. technical issues, poor connection, missing text) leading to misinterpretations of messages from additional uncertainty.
Figure 4. Media richness continuum. Adapted from Daft and Lengel, 1986, with the additions of videoconferencing, instant message, and email.

There were differences in the way messages are communicated with and without physical presence, with and without visual cues. Stephenson and Rutter (1979) determined that for a variety of measures of communication, the total number of visual cues available from visual communication, physical presence, etc. was what most important in the social interaction. Equivocal messages are harder to explain and respond to through email and over the telephone without visual social cues to help build context. This is one major reason why working in virtual teams differs from working in traditional face-to-face teams. The media used to communicate in virtual teams must match the equivocality of the task at hand. Face-to-face communication allowed for instant feedback and fast adjustment and clarification of messages
(Daft et al., 1987) when necessary. Some messages are unequivocal, easily understood, and can be sent via email or instant message clearly. In some cases, face-to-face communication leads to confusion and distraction (Daft & Lengel, 1986), as in instances where “authority, legitimacy, compliance with protocol or lack of urgency” needed to be communicated and written messages were best to do so (Daft & Lengel, 1986).

Message equivocality was not the only determinant used for media selection. Alge et al., (2003) determined that familiar virtual teams fared just as well as face-to-face teams when it came to openness and trust in information sharing. Channel expansion theory suggested that it is not just the communication media and the amount of available cues that determined how well a message would be delivered in a virtual environment. Similar to Schramm’s adaption of the Shannon-Weaver model which includes field of experience (Wagner, 1994), Carlson and Zmud’s (1999) study of channel expansion theory found strong support for the importance of communication media experience and also found that communication partner experience influenced the perception of media richness. While Rains (2008) study showed some support for richness perceptions being explained by communication media and communication partner experience, they found age to account for a large portion of variance in richness perceptions. This made sense when we consider there are four generations in the workplace for the first time in our history, all with different approaches to using technology (Brady & Bradley, 2008). Although sending an email may seem to be a rich enough choice of communicating a particular message in the eyes of a millennial, the baby boomer on the other end may not perceive it as so. Such as the case in the Flammia et al., (2010) study of student global teams where student team members performed well using less rich media (email) to communicate, due to their familiarity with email.
Perceptions are not limited to age differences, less educated communication partners also perceived technological communication tools as less rich forms of communication media (Brady & Bradley, 2008). In face-to-face teams there are also perceptions that influence our communication. The difference is, in virtual teams, if the wrong choice of communication media is made, its negative impacts are more detrimental. There is not the same ability to correct misunderstandings quickly as when communicating face-to-face.

2.7 Preparing Team Members to Work in Virtual Teams

There was a breadth of literature that discussed the differences of working in virtual vs face-to-face teams. Often this research does not make its way to practitioners and “there is a gap between the knowledge and research needs of those who provide education and those who undertake research on educational policy and practice” (Davies, 2000, p. 365). Training specifically for working in virtual teams has been concluded as a necessity for effective virtual team performance (Berry, 2011; Iorio & Taylor, 2014; Monzani et al., 2014). Few studies were dedicated to virtual team communication training, and most of the studies that are have a specific focus on global virtual team communication e.g. Brewer’s (2015) Designing training for global virtual team communication. While working across cultures presents unique challenges, most new, associate employees do not enter the workforce working immediately with global teams, so this literature search did not make that a focal point. Training of virtual teams often focused on developing technology skills and not communication skills of team members (Warkentin & Beranek, 1999a). Pauleen (2003) discussed more research needed to focus on the use and result of training on virtual communication. According to Brewer et al., (2015) “few universities or companies provide structured education and training in virtual team work,” (p. 182) and virtual
team training is often considered in reflection, after errors have already been made (Nemiro, Beyerlein, Bradley, & Beyerlein, 2008).

Literature suggested that technology-mediated teams with a history of working together in virtual teams were able to eliminate the negative differences between virtual and face-to-face teams (Alge et al., 2003) and virtual team training improved the cohesiveness and satisfaction of teams (Warkentin & Beranek, 1999). When building virtual teams, at least some team members should have experience working in virtual teams (Lee-Kelley, 2006) and past experience working in virtual teams was a strong predictor of success (Iorio & Taylor, 2014). Prior leadership training in co-located teams was not always a good predictor of virtual leader effectiveness and team members should at least be given the chance to work as a part of a virtual team before being assigned to lead one (Iorio and Taylor, 2014). While classroom experiences cannot completely imitate working in the real world, experiential courses gave student team members an opportunity to gain experience working in virtual teams through legitimate situations (Brewer et al., 2015).

Incorporating effective virtual team practices into team education would likely empower new virtual team members to take their careers into their own hands. In a 2006 survey of 440 human resource professionals, 70% of responders regarded their virtual team training programs as “not at all effective” or just “slightly effective” (Rosen, Furst, & Blackburn, 2006). In this same survey conducted by Rosen et al., (2006) only 7% of responders regarded their virtual team member and leader training programs as “very effective” or “extremely effective.” Most of the survey participants conveyed that virtual team training was not a top corporate priority and did not receive high support from management. It is evident there is a need to supply effective virtual team training.
By knowing what resources they need to have in place to be successful in a virtual team environment, new employees can enter the workforce prepared to be effective in their roles, as structural supports were strongly related to virtual team performance (Hoch & Kozlowski, 2014). Also by teaching team members how to use common virtual technologies prior to working virtually, difficulties founds to be a consensus in the literature that virtual team members were dissatisfied with the learning curve associated with using virtual technology may be overcome, as well as provide team members experience troubleshooting technological difficulties that virtual team members experienced that hindered performance (Purvanova, 2014). Rosen et al. (2006) also stated that by incorporating proper training in the selection of technologies intended to assist virtual team processes, many organizations’ problems can be reduced.

With training to help improve their effectiveness of interpersonal communication using electronic communication tools, team members were more dedicated to the success of the team and felt more comfortable communicating their thoughts and ideas (Warkentin & Beranek, 1999a). Bergiel et al., (2008) stated that one problem of virtual teams is that every employee was not suited for working in a virtual environment and Lee-Kelley (2006) found that there were differences in attitudes toward working in virtual teams based on team members having either an external or internal locus of control. Rosen et al. (2006), in agreeance with Bergiel et al. (2008), stated that although some employees may not be well-matched psychologically to work completely in a virtual environment, with proper training and support, those team members can be successful on a virtual team. Although Lee-Kelley (2006) did find that locus of control may affect the way employees’ view working on a virtual team, there was no significant correlation between locus of control and role conflict, suggesting that team members with any personality can work effectively in virtual teams with the appropriate training. Team members who understand their adeptness to
virtual work can be prepared to be effective virtual team members and managers; as “when communicating in virtual teams, it is necessary for the media user to possess a sharp awareness gained through experience and training” (Lenz & Machado, 2008, p. 82).

2.8 Research Design

2.8.1 Qualitative Research

The systematic literature review is essentially a qualitative synthesis of studies that tries to recognize the best existing evidence to answer specific research questions (Hemsley-Brown & Sharp, 2003). Qualitative research encompasses an assortment of research practices focused on “achieving an understanding of how people … delineate the process … of meaning-making” (Merriam & Tisdell, 2016). Although the subjects of this study were published research articles, virtuality is a component of everyday operations of teams of many different contexts all over the globe. This systematic literature view is a basic qualitative research study making meaning of the most recent studies of communication in virtual teams. This form of applied research sought to improve the way team members are onboarded for their roles working with team members separated by time and space.

2.8.2 Systematic Literature Review

The systematic literature review has its roots in the healthcare industry and was described as evidence-based practice (Gough & Elbourne, 2002; Hemsley-Brown & Sharp, 2003; Tranfield, Denyer, & Smart, 2003). The use of an evidence-based approach to practice has since become widely used in other disciplines, specifically education (Davies, 2000), social sciences and management, to bridge the gap between researchers and practitioners, and inform policy and practice through a transparent and replicable process (Denyer & Tranfield, 2006). In many cases
experimental studies on virtual teams often result in negative outcomes for virtual teams, which may be due to the fact that many experimental studies use ad-hoc student teams over short periods of time (Martins et al., 2004; Purvanova, 2014). Although it has become more intricate to conduct and analyze field studies on virtual teams (Martins et al., 2004), field case studies on virtual teams contradict many empirical studies and reveal that virtual teams are largely successful in attaining their goals (Purvanova, 2014).

Team communication is often defined and measured differently throughout studies making it difficult to determine which aspects of communication are most important for team functioning (Marlow, Lacerenza, & Salas, 2016). Although documents are not frequently used as data in qualitative research (Merriam & Tisdell, 2016), an in-depth qualitative study of the research provided the opportunity to analyze the variances across studies, acknowledging and accounting for the inconsistencies across studies that a quantitative study may not account for. Systematic literature reviews are an appropriate way to integrate research evidence into practice guidelines and strategies (Cook et al., 2017).

2.8.3 Another evidence-based approach

Systematic reviews are not the only way evidence-based research has been conducted. Meta-analysis, a quantitative approach, stems from the systematic literature review and statistically combines the results of included studies (Bartolucci & Hillegass, 2005). Statistical analysis allows for a quantitative assessment of the significance effect of results (Grant & Booth, 2009). A critique of meta-analysis is the misuse of meta-analysis with studies that are not necessarily analogous (Grant & Booth, 2009). Meta-analysis may or may not accompany a systematic review (Moher et al., 2009).
2.8.4 Reliability of study

Traditional literature reviews often lack the level of rigor and criticality needed to form unbiased conclusions about a research topic (Denyer & Tranfield, 2006; Gough & Elbourne, 2002), thus systematic literature reviews are considered the most trustworthy form of research review (Denyer & Tranfield, 2006). Traditional research reviews focus on a subgroup of studies chosen because of convenience or to fit the author’s agenda. A systematic literature review makes the goals and presumptions supporting a research endeavor unequivocal and “by enhancing the legitimacy and authority of the resultant evidence, systematic reviews could provide practitioners and policy-makers with a reliable basis to formulate decisions and take action” (Tranfield et al., 2003, p. 208). While systematic literature reviews are considered more reliable than traditional research reviews, this study was conducted by a sole researcher, jeopardizing reproducibility. The Prisma Review Checklist (see Appendix) was also used to as guidance to ensure this review captured as much required content for systematic literature reviews as possible for the posed question and research constraints.

2.9 Summary

The goal of this literature review was to convey the need for virtual team communication training for new and future knowledge workers. Virtual communication is the new normal for many team members, yet training on how to communicate in virtual teams has not been sufficient. This review of literature discussed virtuality, benefits and challenges of virtual teams, the theory behind virtual team communication, as well as, the lack of effective virtual team training. Collaboration through virtual means will continue to increase, the cost savings and conveniences encourage most organizations employ at least some use of virtual communication, equivocality
makes virtual communication more difficult, and there is a need to prepare team members to communicate effectively in a virtual environment.

The use of virtual teams has outpaced the virtual communication educational aptitude of team members depending upon virtual communication. Virtual communication tools are used on the daily, yet this change in society has not been incorporated into team building training or objectives for use. There is an abundance of academic literature that has inconsistently defined and measured outcomes of virtual teams. There is a need for a systematic approach to summation, of the literature, and ultimately making it accessible to those preparing the current and next generation of knowledge workers whom will work in virtual teams.
CHAPTER 3. METHODOLOGY

The purpose of this project was to conduct a systematic literature review to identify what communication practices best enable virtual team effectiveness. Working in virtual teams is an inevitable reality for industry, military, medical, government and non-for-profit workers and requires a different skillset than working in traditional face-to-face teams. This project included an investigation into literature describing the theory behind why it is more difficult to communicate effectively in highly virtual teams as opposed to traditional face-to-face teams. The research questions posed in Chapter 1 were:

3 What elements of communication contribute to virtual team effectiveness?
4 What best practices for communication should be included in virtual team training?

This chapter presents the research design and procedure determined to be most satisfactory for conducting a systematic literature review in response to the posed research question.

3.1 Planning the review

The need for this review was identified through a survey of literature. A survey of literature related to virtual teams revealed communication to be a significant factor of virtual team effectiveness and there was a lack of effective virtual team communication training. The following review parameters were adapted from Kable, Pich, and Maslin-Prothero (2012) systematic review protocol. The PRISMA flow chart and checklist (Appendix A) were also used for this review. PRISMA (The Preferred Method for Reporting Systematic Reviews and Meta-analyses) is an “evidence-based minimum set of items for reporting in systematic reviews and meta-analyses. PRISMA focuses on the reporting of reviews evaluating randomized trials, but can also be used as
a basis for reporting systematic reviews of other types of research” (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009).

### 3.1.1 Purpose statement

This systematic literature review was conducted to identify what communication practices best enable virtual team effectiveness. The findings will serve as prescriptive content for virtual team communication training.

### 3.1.2 Databases used

ProQuest ABI/Inform Global was searched for relevant literature. The database covered a wide array of journals relating to business, social science, and educational studies.

### 3.1.3 Search limits

- This search was limited to empirically based peer-reviewed journal articles written in English.
- This search was limited to studies published from January 1, 2012 through 2017. Although a vast amount of literature was published on virtual teams prior to this time (including many commonly cited and primary pieces), some communication tools that are frequently used to communicate among virtual team members, such as email and video-conferencing, were not as widely used prior to the years specified.
- The selected search terms were used to search document abstracts within the ProQuest ABI/Inform Global database.
3.1.4 Inclusion and exclusion criteria

The inclusion criteria for this review were empirical research studies that described team outcomes related to performance and effectiveness based on different communication processes in a virtual team setting. The various types of communication processes analyzed were formal or informal, written or verbal, internal communication patterns between team members. Effects of the communication processes were expected to be positive such as increased team productivity and feelings of comradery or negative such as decreased productivity or feelings of isolation. Pieces were excluded if they were focused on any other variables that influenced effectiveness in a virtual team setting. Other published literature reviews, synthesis, and systematic reviews were excluded, and pieces conceptually or theoretically based were also excluded.

3.1.5 Search terms

The selected search terms were used to search document titles and abstracts. The search term were in conjunction with Boolean and database specific operators (e.g. AND, OR) and special characters (e.g. truncation characters (*) or (?)). The search terms used were: virtual AND team AND communication.

3.2 Conducting the review

3.2.1 Documentation of search process

Document abstracts within the ProQuest database were searched for the terms “virtual” AND “team” AND “effectiveness” to gather peer-reviewed articles from the most recent five years (2012-2017) to be used as data. Abstracts were chosen as the search field, as they are a guide to an articles most significant content. The initial search of ProQuest ABI/Inform Global yielded 82 articles. After the first round of abstract screening, 41 articles remained. Following full text
screening, 16 articles remained and were extracted and analyzed for themes and patterns related to effective virtual team communication.

Figure 5. Systematic literature review flow chart adapted from Moher et al., (2009).

Initially it was planned to search two databases, the ProQuest database that was used and Elsevier ScienceDirect as well. The initial search of ProQuest on October 10, 2017, yielded 82 results, and deemed sufficient sample size to begin abstract screening. In addition, there were articles included in the ProQuest search that had also been published in ScienceDirect.

Covidence.org was used to store abstracts of all search results to aid in the abstract and screening process, and PDF copies of all articles that required full-text screening. Covidence.org is an online service that helps reviewers conduct systematic literature reviews in a timely and streamlined manner. Abstract screening consisted of categorizing studies as “yes”, “no”, or “maybe.” Studies marked “yes” were moved to full-text screening, those marked “maybe” were
also moved to full-text screening, and studies marked “no” were labeled as irrelevant studies as they did not satisfy all inclusion criteria. Full-text screening consisted of viewing the entire document and deciding to “include” or “exclude” studies. Studies selected for inclusion moved to extraction, and studies selected for exclusion were provided reasoning for exclusion: wrong study design, wrong setting, wrong outcomes, or wrong intervention. Due to this review being conducted by a sole researcher, Covidence.org was not used for the final data extraction as Covidence.org’s interface is best fit for multiple reviewers. Data was extracted from each included study following acceptance of full-text screening.

### 3.2.2 Extraction and reporting

The remaining studies from the full-text review were added to the data extraction form (see classification schema in Appendix A). The extraction fields of the data extraction form were created based on initial survey of virtual teams’ literature and what was found to be important to consider in virtual teams studies such as length of study, team type, and methodology which take into account temporal scope of the team. Communication technology type was extracted to account for media richness and measured outcomes were extracted to expose linkages between effectiveness and key performance indicators among teams. Other fields such as author, year, and journal were also included. Article titles were not extracted and instead documents were identified throughout the extraction and reporting phase by number and/or author and year. Because the included studies were produced independent of the study at hand, it took multiple iterations to narrow down to the included data extraction categories.
3.2.3 Assessment of relevance and quality

As with other qualitative studies, the researcher acted as the evaluation instrument for this study. Studies were selected for quality and relevancy based on whether they: (1) involved experiments or cases intended to improve the understanding of the effects of communication on team outcomes, (2) described effects communication patterns had on virtual teams, or (3) determined factors that affected the complexity of team communication and inhibitors of effective communication. The quality assessment criteria that were met during the full-text screening were recorded in the data extraction form.

3.2.4 Data Analysis

The included articles consisted of both qualitative and quantitative studies of student and professional teams in cross-sectional as well as longitudinal studies. In short, there were a variety of studies that fit the inclusion criteria.

Half of the included studies in this research review were of professional teams while the other half of the included studies were of student teams. Previous literature suggested that these types of short-term, ad-hoc lab teams would fail to produce insight applicable to real-life virtual teams (Kirkman & Mathieu 2005; Alge et al., 2003), but included studies show the evolution of virtual team research to incorporate project considerations such as time pressure (Bartelt & Dennis, 2014) and task sequence (Olsen & Olsen, 2013) in controlled lab studies.

<table>
<thead>
<tr>
<th>Team Type</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>8</td>
<td>50%</td>
</tr>
<tr>
<td>Professional</td>
<td>8</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 1. Team Type in Studies
Although the terms cross-sectional and longitudinal are used to refer to studies, that occur either at one point in time (cross-sectional) or over a period (longitudinal). Included studies were categorized as cross-sectional if they involved short-term experiments (Bartelt & Dennis, 2014; Carlson, et al, 2013; Ellwart et al, 2015) or longitudinal if they involved investigating team behaviors throughout a project lifecycle (Fernandez et al, 2015; Ziek & Smulowitz. 2014), or gathered data from experienced professionals (Muganda & Pillay, 2013; Chang et la, 2012). Included articles were also classified as either or if they explicitly stated so in the article.

<table>
<thead>
<tr>
<th>Time Dimension or Length</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal</td>
<td>10</td>
<td>62.5%</td>
</tr>
<tr>
<td>Cross-sectional</td>
<td>6</td>
<td>37.5%</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100%</td>
</tr>
</tbody>
</table>

Determining how to organize the included articles required flexibility on behalf of the researcher. After extracting data from all included studies, content analysis was used to uncover how to categorize the included articles. Included studies were categorized depending on what broad element of virtual team communication the study focused on. This categorization was used to guide the narrative synthesis of the included articles in describing communication best practices for virtual team effectiveness.
Table 3. Categorization of Studies

<table>
<thead>
<tr>
<th>Communication Structures</th>
<th>Communication Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartelt &amp; Dennis 2014</td>
<td>Hovde, 2014</td>
</tr>
<tr>
<td>Cogliser, Gardner, Trank, Gavin, Halbesleben &amp; Seers, 2013</td>
<td></td>
</tr>
<tr>
<td>Fernandez, Bonet, Nabila, 2015</td>
<td></td>
</tr>
<tr>
<td>Pangil &amp; Chan, 2014</td>
<td></td>
</tr>
<tr>
<td><strong>Emergent Leader Communication</strong></td>
<td><strong>Culture and Communication</strong></td>
</tr>
<tr>
<td>Muganda &amp; Pillay, 2013</td>
<td>Klitmoller &amp; Lauring, 2013</td>
</tr>
<tr>
<td>Kahai, Huang &amp; Jestice, 2012</td>
<td>Hovde, 2014</td>
</tr>
<tr>
<td>Morgan, Paucer-Caceres &amp; Wright, 2014</td>
<td>Chang, Hung &amp; Hsieh, 2012</td>
</tr>
<tr>
<td>Ziek &amp; Smulowitz, 2014</td>
<td></td>
</tr>
</tbody>
</table>

3.3 Summary

This section detailed the method for performing the search for qualifying journal articles to be used as data for a systematic literature review, how the articles were assessed for relevance and quality, and analyzed to answer the posed research question and inform virtual team communication training.
CHAPTER 4. RESULTS & SYNTHESIS

The purpose of this study was to conduct a systematic literature review to identify what communication practices enable virtual team effectiveness. The best practices determined from this systematic literature review will serve as prescriptive content for virtual team communication training. This chapter describes the elements of communication that contributed to virtual team effectiveness as determined from analysis of the included studies, and what practices should be included in prescriptive content for virtual team communication training.

4.1 Communication and Virtual Team Effectiveness

Analysis of the included studies revealed how elements of the communication process contributed to effectiveness in virtual teams. Listed below are the key findings from the systematic literature review and discussion following.

<table>
<thead>
<tr>
<th>Contributors</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Frequent and routine communication from virtual team leaders</td>
<td>Sender, Receiver</td>
</tr>
<tr>
<td>(Morgan et al., 2014; Fernandez et al., 2015; Hovde, 2014)</td>
<td></td>
</tr>
<tr>
<td>• Common language (Hovde, 2014)</td>
<td></td>
</tr>
<tr>
<td>• The team’s choice of tools and the team member’s individual needs have to be aligned to ensure team member satisfaction and team performance (Weinmann et al., 2013)</td>
<td>Channel</td>
</tr>
<tr>
<td>• Face-to-face meetings and teleconferencing when possible</td>
<td></td>
</tr>
<tr>
<td>(Morgan et al., 2014; Fernandez et al., 2015; Hovde, 2014)</td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td>Context (field of experience)</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>• Structures for team feedback (STROTA) (Ellwart, Happ, Gurter &amp; Rack, 2015)</td>
<td></td>
</tr>
<tr>
<td>• Opportunities for rapid feedback (Fernandez et al., 2015)</td>
<td></td>
</tr>
<tr>
<td>• Genre rules and communication norms (Bartelt &amp; Dennis 2014)</td>
<td></td>
</tr>
<tr>
<td>• Team cohesion, openness, and experience with communication media (Carlson et al., 2013)</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

Throughout the included literature, there are apparent factors that lead to success among the virtual teams studied. These success factors contributed to virtual team effectiveness and subsequently, performance, particularly in studies of professional virtual teams (Fernandez, Bonet, Nabila, 2015; Chang, Hung & Hsieh, 2012; Pangil & Chan, 2014; Henderson, Stackman & Lindekiilde, 2016; Hovde, 2014; Morgan, Paucer-Caceres & Wright, 2014; Muganda & Pillay, 2013).

Weinmann, Pollock, Scott & Brown, (2013) defined effectiveness as “the achievement of clear goals and objectives” (p. 335). There were several measured outcomes in the included studies that constituted effectiveness including communication quality (Chang, Hung & Hsieh, 2012), decision quality (Bartelt & Dennis, 2014), task completion time (Olsen & Olsen, 2013), and task score (Ziek & Smulowitz, 2014). In some of the articles, effectiveness was based on team members’ perception of their performance, and not an observable or measurable phenomenon (Pangil & Chan, 2014; Carlson, Carlson, Hunter, Vaughn & George, 2013, Muganda & Pillay). Carlson et al., (2013) post-test assessment collected team members perceived effectiveness, asking team members if they thought their team would score above average of all other teams in the activity. It also asked whether or not they were able to add value to the team, how well the team
worked together, and whether or not they believed they were more successful working as a team on the activity versus had they attempted the activity themselves. Weinmann et al. (2013) described three criteria of team effectiveness as “the productive output of the team, the social processes the team uses, and the team's contributions to the well-being and growth of its members” (p. 335).

Teams considered to be effective exhibited several characteristics and behaviors that led to team success. Effective virtual teams scheduled regular meetings (Morgan et al., 2014; Fernandez et al., 2015; Hovde, 2014). Effective virtual teams accentuated the importance of face-to-face meetings at the inception of projects and used teleconferencing whenever available (Morgan et al., 2014; Fernandez et al., 2015; Hovde, 2014). Effective virtual teams also had a strategy around team communication and made “coordinated and focused information exchange” (Ellwart, Happ, Gurter & Rack, 2015) a priority.

The successful two yearlong virtual research and development project from Fernandez et al. (2015) case study commenced with a two-day long face-to-face seminar to address project logistics prior to beginning the required tasks. This initial face-to-face interaction coupled with a project leader who emphasized “direct and synchronous” communication led to a project delivered, on time, on budget, while adhering to high quality standards. Morgan et al. (2014) examined of the relationship between limited range of communication and effectiveness and determined that frequent communication was more important for virtual team effectiveness than communication medium, and emphasized the significance of “routine and consistent” communication among virtual team members.

Carlson et al. (2013) linked team cohesion, openness, and experience with instant message to effectiveness in virtual teams. Their experiment demonstrated that experience with instant
message allowed team members to share knowledge more openly, therefore contributing to virtual team effectiveness. Pangil & Chan (2014) examined the mediating effect of knowledge sharing on the relationship between trust and virtual team effectiveness determined that “knowledge sharing is also significantly related to virtual team effectiveness” (p. 101). Trust is also paramount in linking virtual teams and effectiveness (Pangil & Chan, 2014; Henderson, Stackman & Lindekilde, 2016), with cognitive-, personality-, and institution-based trust all found to directly and indirectly affect virtual team effectiveness in a positive way (Pangil & Chan, 2014). Respect for and trust in team members enabled effective communication in a multicultural virtual engineering design team.

### 4.2 Communication Best Practices

I now direct attention to the four best practice areas that encapsulate the communication practices that enable virtual team effectiveness: (a) communication structures in virtual teams, (b) communication channels, (c) characteristics of emergent leader communication, and (d) culture communication. These best practices areas were categorized by recurring patterns that were revealed throughout the literature, across different kinds of studies. Based on analysis of the included studies, this section suggests best practices to enable virtual team effectiveness and discusses the implications of these recommendations.

#### 4.2.1 Communication structures in virtual teams

<table>
<thead>
<tr>
<th>Communication Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartelt and Dennis (2014) found that genre rules not only had a significant effect on virtual team behavior and performance but genre rules varied with the use of different communication media.</td>
</tr>
</tbody>
</table>
• Ellwart et al (2015) found that teams that executed an entire structured online team adaptation procedure (STROTA) for communicating feedback enhanced their team mental model and lessened team information overload.

• Interviews from Henderson et al. (2016) revealed several threats to aligning virtual team communication norms, most of which imply lack of knowledge about project stakeholders; not knowing whom to communicate with about what.

• “…information technologies are only part of the solution,” (p. 1703) and that the success of such projects is down to a balanced combination of face-to-face and computer-mediated communication (Fernandez et al., 2015).

<table>
<thead>
<tr>
<th>Best Practices</th>
<th>Implications for Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Meet regularly and synchronously whenever possible.</td>
<td>New virtual team members who are made aware of the complex social structures of virtual teams can be prepared to make an immediate, positive impact in virtual teams.</td>
</tr>
<tr>
<td>• Align and proactively enact communication norms and genre rules that establish and maintain expectations among virtual team members.</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

Virtual team communication structures were apparent as a major area in the included studies (Bartelt & Dennis, 2014; Chang et al., 2012; Ellwart et al., 2015; Henderson et al., 2016). The communication structures in virtual teams are referred to as the communication norms and genre rules, which dictate team interaction. Communication norms customarily include expectations or established policies for practices such as how messages should be exchanged, transferring different types of intelligence with different communication tools, and procedures for
Determining urgency in response rate among virtual and collocated team members (Henderson et al, 2016). Genre rules are defined as “the social structures that guide the form and substance of communication” (Bartelt & Dennis, 2014, p. 522). Communication norms are generally intentionally set to develop effective and efficient communication practices among team members, or they can emerge over time (Henderson et al., 2014) from the natural course of team interaction. Ellwart et al (2015) found that teams that executed an entire structured online team adaptation procedure (STROTA) for communicating feedback enhanced their team mental model and lessened team information overload. These results further emphasized team communication norms and that having a plan around team communication and “more focused and coordinated information exchange” (Ellwart et al., 2015) improves team mental model, and effectiveness.

Development of communication norms and role clarity also helped formulate trust among virtual team members (Henderson et al., 2015). However, an interesting finding from Chang et al. (2012) was when using communication frequency as a measurement of communication quality, there was a negative effect on virtual team performance when team trust was high, indicating that communication norms need to continually evolve as teams mature. I agree with Henderson et al. (2015) that it is best to establish communication norms early on, proactively, as opposed to allowing a potentially negative team culture to develop where team members make assumptions, feel isolated, lack feedback and lack shared mental models which has detrimental impacts on team effectiveness. A key takeaway from Hovde (2014) was the importance of enacting communication norms such as standard templates for presentations to communicate among team members of different backgrounds, expertise, and cultures.

Bartelt and Dennis (2014) found that genre rules not only had a significant effect on virtual team behavior and performance but genre rules varied with the use of different communication
media, notably instant messenger and discussion forum. Their experiment determined the variation in results among the normal use of instant messenger and discussion forum was not due to the differences in the media themselves, but result of the genre rules the team members implemented. Being aware of genre rules can help team members choose the correct communication media to relay specific information, whether social or task related.

Interviews from Henderson et al. (2016) revealed several threats to aligning virtual team communication norms, most of which imply lack of knowledge about project stakeholders; not knowing whom to communicate with about what. Ellwart et al. (2015) argued based on the results of their experiment with STROTA that the “structuring of roles, responsibilities, and strategies during the plan formulation phase enabled team members to know better when to ask for information and whom to send information to.” It is clear that having a plan around virtual team communication can help combat communication challenges virtual teams face. By establishing communication best practices, virtual teams can make effective communication decisions and avoid costly communication mistakes.

4.2.2 Communication channels

<table>
<thead>
<tr>
<th>Communication Channels in the Included Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Carlson et al., (2013) recognized four essential experiences that enable rich communication: experience with medium, experience with communication co-participants, experience with communication topic, and experience with communication context” (p. 6).</td>
</tr>
<tr>
<td>• Teams that encountered limited internet availability and bandwidth issues had lessened effectiveness and performance level because of their inability to use all task tracking/planning tools (Weinmann et al., 2013).</td>
</tr>
<tr>
<td>• Hovde (2014) recommended that engineering educators and trainers focus on the constitutive role of technology in co-constructing virtual team communication.</td>
</tr>
</tbody>
</table>
• Weinmann et al. (2013) found that “internet access and availability, tool training, usability tool integration, and task management” (p. 344) were the major determinants in deciding which virtual communication tools were used.

<table>
<thead>
<tr>
<th>Best Practices</th>
<th>Implications for Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Before selecting a communication technology, take into consideration what it is being used for and what could prevent it from working effectively.</td>
<td>New team members are made cognizant of how their technology choices affect their communication outcomes, leading to wiser decision-making and more effective virtual team communication.</td>
</tr>
<tr>
<td>• Not only is it about media richness, but also synchronicity, and technological barriers such as internet availability.</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

Hovde (2014) recommended that engineering educators and trainers focus on the constitutive role of technology in constructing virtual team communication. Weinmann et al. (2013) found that the chosen tools for “communication, collaboration, and project management” affected virtual team performance. Their research went beyond media richness theory (Daft & Lengel, 1986) and incorporated media synchronicity theory (MST), which focused on the ability of communication media to match the synchronicity that a communication process requires (Weinmann et al., 2013). Breaking virtual team communication into a combination of conveyance and convergence tasks, where the communicators choose communication media that will allow the appropriate amount of time to respond, whether rapid feedback (convergence) is most appropriate
or if receivers need time to deeply process the exchanged information (conveyance). In other words, media is not selected because it is most rich, but based on its ability to communicate what is necessary. As Hovde (2014) stated, “choosing the richest forms of communication technology and using it wisely” (p. 263).

MST does not bear in mind how communication media experience and partner experience influence perception of media richness. Carlson et al. (2013) built on previous channel expansion theory (Carlson & Zmud, 1999) and pinpointed four fundamental experiences that enable rich communication through a given communication technology: “experience with medium, experience with communication co-participants, experience with communication topic, and experience with communication context” (Carlson et al., 2013, p. 6). Weinmann et al. (2013) also determined that for a technology to have a helpful influence on a user's personal performance, its appropriateness for the task and context (project context, work preference) must be considered. Take videoconferencing for example, if simply relying on media richness theory, where visual cues are the important determine of communication effectiveness, when unable to have a face-to-face meeting, it would be expected for videoconferencing to be the next best choice for communicating. Lags in communication that make an almost face-to-face conversation asynchronous, network interferences, battery life issues, and other technological barriers, or contexts, negatively influence the richness of the videoconference, despite its ability to make visual cues available. Video-conferencing is also not a viable option where time zone differences exist and conversations must happen away from normal business hours when structural supports are less available to help troubleshoot (Gibson & Cohen, 2003).

Weinmann et al. (2013) found that “internet access and availability, tool training, usability tool integration, and task management” (p. 344) were the major determinants in deciding which
virtual communication tools were used. Teams that encountered limited internet availability and bandwidth issues had lessened effectiveness and performance level because of their inability to use all task tracking/planning tools.

4.2.3 Characteristics of emergent leader communication

<table>
<thead>
<tr>
<th>Emergent Leader Communication in Included Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Examination of the student team messages showed that emergent leaders posted 42% more words than other team members, and teams with leaders who communicated most effectively, with frequent &amp; procedural messages, performed better on their final grades. (Ziek &amp; Smulowitz, 2014).</td>
</tr>
<tr>
<td>• The included studies suggested that transformational and participative leadership behaviors are more important in teams where communication is inhibited by technology (Muganda &amp; Pillay, 2013; Kahai et al., 2012)</td>
</tr>
<tr>
<td>• Leader’s “synchronous meeting and frequent regular interaction” developed the high-quality relationships that prompted high performance among virtual R&amp;D project teams (Fernandez, 2015).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Best Practices</th>
<th>Implications for Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Take responsibility for team communication, communicate frequently, and with the end in mind.</td>
<td></td>
</tr>
<tr>
<td>• Engage with participative leadership style and express personality.</td>
<td></td>
</tr>
<tr>
<td>• Be persistent in overcoming technological barriers and added effort required to communicate effectively in virtual teams.</td>
<td></td>
</tr>
<tr>
<td>New virtual team members would be made aware of what constitutes effective communication from a virtual team leader and able to take steps to enacting these behaviors.</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

Characteristics of emergent leadership communication was also unveiled as critical area of content for virtual team effectiveness. Ziek and Smulowitz (2012) argued that the emergence of virtual team leadership is communicatively constructed. Leadership, “a process whereby an individual influences a group of individuals to achieve a common goal” (Fernandez et al., 2015, p. 1695), is significantly linked to virtual team effectiveness (Ziek & Smulowitz, 2012; Kahai et al., 2012). Effective communication should be the responsibility of every team members but as Morgan et al., (2014) explicated:

Whilst it was ultimately the responsibility of the team and the individuals within the team to ensure that effective communication takes place, it is the team leader’s responsibility to set the standard, the expectations and the communication framework. (p. 620)

I expected that if leadership presented itself, it would be studied as leadership effectiveness; however, as Purvanova and Bono (2009) point out, “leadership emergence is likely to be more stable than leadership behavior because emergence is more strongly correlated with personality, and intelligence, than is leadership effectiveness” (p. 345)/ Morgan et al. (2014) extended global virtual team leader communication approaches that are valuable to team effectiveness, Fernandez et al. (2015) found that dynamic and positive leadership is significant for strengthening virtual team member relationships. Ziek and Smulowitz (2014) performed content analysis on semester long student project teams to understand the competencies that emergent leaders used to earn the highest scores on semester long team projects. Kahai et al. (2012) examined how technology and leadership styles interacted to influence feedback positivity and group efficacy and other perceptual measured outcomes among two different virtual communication tools.
Based on the outcomes from the selected studies, there are several communication behaviors characteristic of emergent leaders in virtual settings. Effective virtual team leaders communicated more frequently (Ziek & Smulowitz, 2014; Fernandez et al., 2015), communicated to keep the team focused on moving forward (Ziek & Smulowitz, 2014), and emergent virtual team leaders utilized transformational leadership (Kahai et al., 2012; Muganda & Pillay, 2013) and participative leadership styles (Muganda & Pillay, 2013).

Ziek & Smulowitz (2014) conducted a semester long study analyzing student team interactions during a major class project. Examination of the student team messages showed that emergent leaders posted 42% more words than other team members. Teams with leaders who communicated most effectively, with frequent & procedural messages, performed better on their final grades. Fernandez 2015 case study of a virtual research and development (R&D) project team found “synchronous meeting and frequent regular interaction” developed the high-quality relationships that prompted high performance among virtual R&D project teams. Muganda and Pillay (2013) demonstrated that effective communication and high performance was achieved through asynchronous communication (IM). Leadership used both structured charismatic exchange “where the focus is on how the project leader projects his/her personality to influence people”, and decentralized team leadership where “project goals and decisions emerge from bargaining, negotiating, and jockeying for position among members of different coalitions” to drive effective communication and performance (Muganda & Pillay, 2013).

The included studies suggested that transformational and participative leadership behaviors are more important in teams where communication is inhibited by technology (Muganda & Pillay, 2013; Kahai et al., 2012). This is in line with Purvanova and Bono (2009) whose results proposed that transformational leadership had a stronger effect in teams using only communication
technology. Transformational leaders impart charisma; they appeal to feeling and emotions, and communicate energy and confidence. Transformational virtual leaders must continually overcome the technological barriers, frustrations, and additional effort required to communicate effectively in virtual environments.

Kahai et al. (2012) suggested that Social Identity Model of Deindividuation (SIDE) is probable to have an effect on the interaction between leadership style and communication technologies. Even in a country where hierarchical power distance is typically high; interviews of virtual team members from teams in South Africa revealed that power distance was perceived to be equal when communicating in an asynchronous virtual project environment, which was also indicative of SIDE theory’s impact on team member behavior with varying virtual communication tools.

4.2.4 Culture and communication

<table>
<thead>
<tr>
<th>Communication Culture in Included Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Klitmoller and Lauring (2013) found that intensity of “cultural and linguistic” variation among virtual team members should dictate how communication tools are selected.</td>
</tr>
<tr>
<td>• A wide array of factors inhibited communication among global virtual team members such as differences in cultural assumptions, relations between work and life, different understandings of ‘yes’, varying levels of reticence and assertiveness …” etc. (Hovde, 2014, p. 255-258).</td>
</tr>
<tr>
<td>• A key takeaway from Hovde (2014) was the importance of enacting communication norms such as standard templates for presentations to communicate among team members of different backgrounds, expertise, and cultures.</td>
</tr>
<tr>
<td>• Although cultural differences fueled variations of “meaning and approach” and discrepancies in “communication and commitment,” Morgan (2014) extended that global virtual teams can overcome limited communication availability and achieve effectiveness.</td>
</tr>
<tr>
<td>Best Practices</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>• Avoid generalizations about cultures, encourage</td>
</tr>
<tr>
<td>students to be attentive and thoughtful.</td>
</tr>
<tr>
<td>• Utilize standard operating procedures and templates</td>
</tr>
<tr>
<td>for team tasks, procedures, and documents.</td>
</tr>
</tbody>
</table>

**Discussion**

It is difficult to separate the global and cultural issues associated with virtual teams as virtual teams are essentially a result of globalization (Lenz & Machado, 2008). Many virtual teams consist of team members from different countries, teams that are working in partnerships with different organizations and even virtual teams that consist of team members from different departments in a single organization (e.g. cross-functional teams comprised of marketing, finance, operations). The language used to communicate differs among different individual team member, organizational, and global cultures. It is important to understand those that are on the other side of the communication technology. It is especially important to exercise proactive team communication norms like arranging a face-to-face meeting to kick off a project. Having those visual cues available help to develop initial relationships as team members are exposed to inherent differences, form better understanding of one another, and begin to cultivate shared mental models.

Culture and language showed up as barriers particularly in the included case studies (Hovde, 2014; Morgan et al., 2014; Klitmoller & Lauring, 2013; Chang et al., 2012). Hovde
(2014) sought to understand the constituents of effective communication in an engineering virtual team. Morgan et al. (2014) extended that global virtual teams can overcome limited communication availability and achieve effectiveness. Klitmoller & Lauring (2013) investigated the effects of communication technology, culture, and shared language on knowledge sharing. Chang et al. (2012) explored how virtual team members assimilated to team culture and implications of that assimilation on communication quality and trust among team members.

Virtual team members must be aware of how their interactions are affected by the intricacies of cultural differences. Cultural adaptation is important for the health of virtual teams (Chang et al., 2014). A wide array of factors inhibited communication among global virtual team members: “differences in cultural assumptions, relations between work and life, importance of corporate hierarchy and authority, decision-making processes, differences in communication styles, authority of written documents, different understandings of 'yes', varying levels of reticence and assertiveness, varying levels of risk tolerance, varying levels of optimism and pessimism, and differing assumptions about appropriate behavior and communication norms (Hovde, 2014, p. 255-258). Cultural differences fueled variations of “meaning and approach” and discrepancies in “communication and commitment” (Morgan et al., 2014). However, challenges virtual teams face due to cultural differences can be mediated by the choice of communication tools (Klitmoller & Lauring, 2013). Klitmoller and Lauring (2013) found that intensity of “cultural and linguistic” variation among virtual team members should dictate how communication tools are selected (Chang et al., 2012).

Although the cultural focus of the included studies in this project reflected the interactions of global virtual teams, I purport that there are cultural differences that exist among teams that are of the same global culture and speak the same first language. These cultural differences extend
from having different experiences, coming different organizational departments, and performing different task functions.

4.3 Summary

This chapter explicated elements of communication that contributed to effectiveness in virtual teams. Also, four areas of communication best practices were identified and presented in this thesis: social structures, technology choices, leader communication, culture and language and lend themselves as a foundation for building content for virtual team communication training. In the following chapter the implications of this research are discussed, along with limitation and directions for future research.
CHAPTER 5. CONCLUSION

Virtual team effectiveness is conducted through communicative processes that are not widely trained on. The effect of this lack of training are virtual teams that do not perform at their peak potential. It is up to organizations employing virtual teams to incorporate virtual team member training that helps virtual team members communicate effectively, which ultimately enables high performance. The systematic literature review has proven to be an exceptional method for informing educational policies and there are not many other ways to ensure that the recommendations made in this project reflected and incorporated the most relevant findings of communication best practices that enable virtual team effectiveness. In this section, the limitations of this study are discussed, along with directions for future research.

5.2 Limitations

One limitation of this study is that empirical studies in virtual team communication are commonly conducted with data from self-reported questionnaires. Parts of the insights proposed from this systematic literature review were based on results of studies that relied on self-reported data, which may lead to response bias. Self-reported questionnaires have many benefits for researchers, helping to measure constructs such as effectiveness, which can be challenging to obtain through behavioral measures. In addition, a portion of the included studies (8 of 16) utilized student teams, which are not always representative of how virtual teams function in professional settings. Although half of the studies included in this review were of student teams, these studies considered factors such as time pressure (Bartelt & Dennis, 2014) and task sequence (Olsen & Olsen, 2013) to simulate potential causal factors.
Another limitation of this study is that a sole researcher conducted it. Systematic literature reviews typically are conducted by a team of two or more researchers whom come to a consensus about which studies to include. Without a second researcher to take part in quality assessment, this research is subject to the partiality of a sole researcher. In that sense, this review was more ‘systematized’ (Grant & Booth, 2009) and not completely exhaustive.

This systematic literature review only includes journal articles, although there can be valuable contributions to this topic from book chapters, conference proceedings, etc. Lastly, this study only included articles written in English, which limits access to findings that are written from other lingua-franca perspectives, especially as it relates to social structures, culture and language.

5.3 Conclusion and Future Research

There are numerous ways the insight offered in this thesis can be continued for future efforts. Future research can take the best practices found here and experiment with the best ways to conduct virtual team communication training and determine what content contributes most to virtual team effectiveness and performance. Future virtual teams’ research can also consider new communication tools and their cultural fit with different organizational (functional, matrix, etc.) and team structures (low vs. high virtuality). Needs assessments can be developed and tested to determine more specific training needs. While the complexities of this research endeavor could not have been predicted, the results of this project present a formidable attempt to inform virtual team communication trainers of the most critical instructional content that will lead to virtual team effectiveness.

This project began by arguing that virtual teams are more prevalent than ever and will only continue to be utilized by organizations in many different contexts. Communication is an
important core competency for every team, but it becomes tricky among virtual team members who lack face-to-face contact and are separated by time and space. Conducting a systematic literature review allowed for a stringent approach to answering the posed questions and recommendations are offered as a foundation upon which to build virtual team communication training.
## APPENDIX A – DATA EXTRACTION

### A.2 Data Extraction Spreadsheet

<table>
<thead>
<tr>
<th>No</th>
<th>Author &amp; year</th>
<th>Outcome measured</th>
<th>Methodology</th>
<th>Team type</th>
<th>Time Dimension</th>
<th>Virtual tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bartelt &amp; Dennis 2014</td>
<td>effectiveness: decision quality</td>
<td>2x2 experiment</td>
<td>students</td>
<td>short term (cross-sectional)</td>
<td>IM, discussion forum</td>
</tr>
<tr>
<td>2</td>
<td>Fernandez, Bonet, Nabilla, 2015</td>
<td>project success</td>
<td>case study method</td>
<td>professional</td>
<td>2 years (longitudinal)</td>
<td>teleconferencing, email rules, ZF</td>
</tr>
<tr>
<td>3</td>
<td>Carlson, Carlson, Hunter, Vaughn &amp; George, 2013</td>
<td>effectiveness based on 4 survey items</td>
<td>survey and hierarchical moderated regression and multilevel analysis</td>
<td>students</td>
<td>short term activity (cross-sectional)</td>
<td>IM</td>
</tr>
<tr>
<td>4</td>
<td>Chang, Hung &amp; Hsieh, 2012</td>
<td>communication quality: accurate, adequate, complete, credible</td>
<td>study to test framework, mixed methods (interviews, questionnaire)</td>
<td>professionals from Taiwanese organizations</td>
<td>various employees with experience working in virtual team environment (longitudinal)</td>
<td>virtual team in general</td>
</tr>
<tr>
<td>5</td>
<td>Cogliser, Gardner, Trank, Gavin, Halbesleben &amp; Seers, 2013</td>
<td>group exchange structures, team performance, team member satisfaction</td>
<td>content analysis</td>
<td>students</td>
<td>longitudinal</td>
<td>threaded discussion, email, chats, document sharing</td>
</tr>
<tr>
<td>6</td>
<td>Ellwart, Happ, Guter &amp; Rack, 2015</td>
<td>team mental model - 7 item scale</td>
<td>experiment</td>
<td>student teams</td>
<td>cross-sectional</td>
<td>STROTA, email</td>
</tr>
<tr>
<td>7</td>
<td>Pangli &amp; Chan, 2014</td>
<td>effectiveness, knowledge sharing, trust (personal, cognitive, institutional)</td>
<td>quantitative, cross-sectional, questionnaire</td>
<td>professionals</td>
<td>cross-sectional</td>
<td>virtual teams (different media choices)</td>
</tr>
<tr>
<td>8</td>
<td>Henderson, Stackman &amp; Lindekiide, 2016</td>
<td>communication freq, communication norm alignment, role clarity, satisfaction, interpersonal trust, performance</td>
<td>mixed methods, used survey</td>
<td>global professionals</td>
<td>longitudinal</td>
<td>virtual teams (different media choices)</td>
</tr>
<tr>
<td>9</td>
<td>Hovde, 2014</td>
<td>predominant effects from team meetings, interactions, interviews</td>
<td>observational case study</td>
<td>engineering</td>
<td>5 months (longitudinal)</td>
<td>virtual meetings (telephone)</td>
</tr>
<tr>
<td>10</td>
<td>Morgan, Paucer-Caceres &amp; Wright, 2014</td>
<td>effectiveness: the team's viability and performance</td>
<td>qualitative, interviews</td>
<td>professional</td>
<td>longitudinal</td>
<td>different media choices</td>
</tr>
<tr>
<td>11</td>
<td>Olsen &amp; Olsen, 2013</td>
<td>effectiveness: amount of time group needs to complete tasks</td>
<td>2x2 experimental design</td>
<td>ad-hoc student teams</td>
<td>short term (cross-sectional)</td>
<td>synchronous computer-mediated chats</td>
</tr>
<tr>
<td>12</td>
<td>Ziek &amp; Smulowitz, 2014</td>
<td>predominant effects from team meetings, interactions, interviews</td>
<td>mixed, survey and content analysis</td>
<td>student teams</td>
<td>semester (longitudinal)</td>
<td>online course management system</td>
</tr>
<tr>
<td>13</td>
<td>Kahai, Huang &amp; Jestice, 2012</td>
<td>group efficacy, decision quality</td>
<td>2x2 experimental study</td>
<td>ad-hoc student teams</td>
<td>cross-sectional</td>
<td>IM and Second Life (SL)</td>
</tr>
<tr>
<td>14</td>
<td>Weinmann, Pollock, Scott &amp; Brown, 2013</td>
<td>team performance, team satisfaction, team effectiveness</td>
<td>grounded theory</td>
<td>student teams</td>
<td>1 year (longitudinal)</td>
<td>email, sms, phone, MS project, skype, etc.</td>
</tr>
<tr>
<td>15</td>
<td>Muganda &amp; Pillay, 2013</td>
<td>group effectiveness: the percentage grades given by the instructors for the final recommendations</td>
<td>mixed methods, quantitative survey and interviews</td>
<td>professionals</td>
<td>longitudinal</td>
<td>Asynchronous VPE</td>
</tr>
<tr>
<td>16</td>
<td>Klitmoller &amp; Lauring, 2013</td>
<td>predominant effects from team meetings, interactions, interviews</td>
<td>ethnographic case study, interviews</td>
<td>professionals</td>
<td>longitudinal</td>
<td>different media choices</td>
</tr>
</tbody>
</table>
To examine the relationship between trust and virtual team effectiveness.

To examine whether high-quality relationship building in virtual teams can improve communication quality.

To investigate how the use of tools affects communication patterns and virtual team effectiveness.

To determine how the selection and use of tools for communication can influence team effectiveness.

To examine the effects of leadership on virtual team performance.

To study the impact of leadership style on team performance.

To determine how critical technology-related issues influence team performance and satisfaction of virtual project teams.

To investigate the effects of leadership in an asynchronous virtual environment.

To examine the effects of culture, shared language, community, and media on knowledge sharing.

A.2 Relevance and Quality Spreadsheet

<table>
<thead>
<tr>
<th>Author &amp; year</th>
<th>Objective</th>
<th>Effects on team outcomes</th>
<th>Communication patterns</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartelt &amp; Dennis, 2014</td>
<td>To examine the impact of genre rules with different behaviors that affect decision quality.</td>
<td>It was hypothesized that when users are in a habitual task situation, more discussions using IM would be task-focused than those using MO.</td>
<td>Task and non-task related messages exchanged significantly affected decision quality and enjoyment but not perceived effectiveness.</td>
<td>Task and non-task related messages exchanged significantly affected decision quality and enjoyment but not perceived effectiveness.</td>
</tr>
<tr>
<td>Fernandez, Benet, Nablo, 2015</td>
<td>To identify variables that enable high-quality relationship building in virtual teams and analyze their influence on performance.</td>
<td>The project manager encouraged exchange of information and interaction between members and both collected communication tools.</td>
<td>Regular meetings increased interaction frequency which led team members to develop rapport. Rule: Move to email was exchanged to ask questions, questions and clarifications were required in meetings.</td>
<td>Need and non-task related messages exchanged significantly affected decision quality and enjoyment but not perceived effectiveness.</td>
</tr>
<tr>
<td>Carlson, Carlson, Hunter, Vaughn, George, 2013</td>
<td>To investigate the moderating role of experience with instant messaging on the team (interpersonal) process to team effectiveness relationship in virtual teams.</td>
<td>(1) Cohesion was positively related to team effectiveness. (2) Openness was positively related to team effectiveness.</td>
<td>Cohesion was positively and significantly related to effectiveness. (1b) Openness was positively and significantly related to effectiveness.</td>
<td>Cohesion was positively and significantly related to effectiveness. (1b) Openness was positively and significantly related to effectiveness.</td>
</tr>
<tr>
<td>Chang, Hung, &amp; Hsi, 2012</td>
<td>To explain how the members adapt to virtual team culture and how the adaptation affects communication quality and facilitates interpersonal trust with the team.</td>
<td>A positive relationship existed between the cultural adaptation and the communication quality in virtual teams.</td>
<td>All hypotheses were supported except for which showed communication quality to have a negative effect on virtual team performance -- opposite of most research.</td>
<td>All hypotheses were supported except for which showed communication quality to have a negative effect on virtual team performance -- opposite of most research.</td>
</tr>
<tr>
<td>Cigliano, Gardiner, Trank, Davis, Hartley, 2013</td>
<td>To identify group exchange structures and determine isolates.</td>
<td>The highest levels of team performance will be achieved when VTLs and virtual teams are unified.</td>
<td>There was no difference in team performance based on exchange structures. There was a significant relationship among members of the dominant subgroup and negative exchange relationships among isolate members with this subgroup and other members.</td>
<td>There was no difference in team performance based on exchange structures. There was a significant relationship among members of the dominant subgroup and negative exchange relationships among isolate members with this subgroup and other members.</td>
</tr>
<tr>
<td>Ulhart, Hopp, Guter, &amp; Rack, 2015</td>
<td>To determine if a structured online team adaptation enables virtual teams to reduce information overload by improving their team mental model quality.</td>
<td>There was no significant difference in team performance based on communication norm alignment.</td>
<td>As predicted, teams following the complete STROTA reported better quality and sharedness of team mental model, and reported less information overload and received fewer emails.</td>
<td>As predicted, teams following the complete STROTA reported better quality and sharedness of team mental model, and reported less information overload and received fewer emails.</td>
</tr>
<tr>
<td>Pang &amp; Chen, 2014</td>
<td>To examine the relationship between trust and virtual team effectiveness.</td>
<td>(1) There is a significant positive relationship between trust and team effectiveness.</td>
<td>There was a significant positive relationship between trust and virtual team effectiveness.</td>
<td>There was a significant positive relationship between trust and virtual team effectiveness.</td>
</tr>
<tr>
<td>Henderson, Stockman, &amp; Lindkilde, 2016</td>
<td>To determine how role clarity and trust function with the alignment of communication norms to influence global project team members’ satisfaction and performance.</td>
<td>(3b) Alignment of communication norms among GFT members will positively impact their project performance.</td>
<td>Interviews clearly demonstrated communication norm alignment is critical to individual perceptions of project satisfaction and performance.</td>
<td>Interviews clearly demonstrated communication norm alignment is critical to individual perceptions of project satisfaction and performance.</td>
</tr>
<tr>
<td>Hovak, 2016</td>
<td>To understand the dynamics of engineering communication in virtual teams.</td>
<td>Communication is regular and scheduled and communication is convenient and available to all members.</td>
<td>Factors that enable communication being part of the same company, cross-cultural training, regularly scheduled meetings, efficient communication technologies, face-to-face opportunities to interact, respect for and trust in partners, shared focus on pre-assignments.</td>
<td>Factors that enable communication being part of the same company, cross-cultural training, regularly scheduled meetings, efficient communication technologies, face-to-face opportunities to interact, respect for and trust in partners, shared focus on pre-assignments.</td>
</tr>
<tr>
<td>Morgan, Pauser, &amp; Carimi, 2013</td>
<td>To investigate the relationship between limited-range of communication and effectiveness.</td>
<td>Where a limited range of communication is available, there will be a lower level of effectiveness within the team.</td>
<td>Communication is regular and scheduled and communication is convenient and available to all members.</td>
<td>Communication is regular and scheduled and communication is convenient and available to all members.</td>
</tr>
<tr>
<td>Olsen &amp; Olsen, 2013</td>
<td>To examine the sequence of group task pressure and communication medium conditions on group effectiveness.</td>
<td>(1) Groups starting with rich media conditions will reduce the amount of time groups need to complete their tasks. (2a) There was a significant relationship between group starting position related to communication condition and group effectiveness.</td>
<td>Emergent leaders communicate more frequently, and post longer messages; leaders posted 42% more words than other group members; leaders averaged 64 words per post and others averaged less than 1.</td>
<td>Emergent leaders communicate more frequently, and post longer messages; leaders posted 42% more words than other group members; leaders averaged 64 words per post and others averaged less than 1.</td>
</tr>
<tr>
<td>Zink &amp; Smulowitiz, 2014</td>
<td>To examine which emergent leadership competencies most impact virtual team effectiveness.</td>
<td>Leaders with higher scores participated on teams that were more effective.</td>
<td>Emergent leaders communicate more frequently, and post longer messages; leaders posted 42% more words than other group members; leaders averaged 64 words per post and others averaged less than 1.</td>
<td>Emergent leaders communicate more frequently, and post longer messages; leaders posted 42% more words than other group members; leaders averaged 64 words per post and others averaged less than 1.</td>
</tr>
<tr>
<td>Kahin, Huang, &amp; Sexton, 2012</td>
<td>To study the effect of leadership in virtual teams.</td>
<td>(6d) Feedback positivity will be positively related to group efficacy—supported, 6(d) feedback negativity will be negatively related to decision quality—supported.</td>
<td>Internet access and availability: The role of the internet as a causal factor is most apparent where the project manager encouraged exchange of information and interaction between members.</td>
<td>Internet access and availability: The role of the internet as a causal factor is most apparent where the project manager encouraged exchange of information and interaction between members.</td>
</tr>
<tr>
<td>Westman, Pollock, Scott, &amp; Brown, 2013</td>
<td>To determine how critical technology-related issues concerning the selection of tools and the use of web-based tools influence the performance and satisfaction of virtual project teams.</td>
<td>The selection and use of tools for communication/collaboration/project management influence the virtual team’s performance.</td>
<td>For a technology to have a positive impact on a user’s individual performance, the suitability for the task at hand must be taken into account (work context, work preferences, channel expansion theory).</td>
<td>For a technology to have a positive impact on a user’s individual performance, the suitability for the task at hand must be taken into account (work context, work preferences, channel expansion theory).</td>
</tr>
<tr>
<td>Muggins &amp; Pillay, 2015</td>
<td>To investigate the effects of leadership in an asynchronous virtual environment.</td>
<td>The results indicate a significant finding which linked leadership effectiveness to asynchronous VFL usage and communication. (Structural causality examination and participative and shared leadership).</td>
<td>The results indicate a significant finding which linked leadership effectiveness to asynchronous VFL usage and communication. (Structural causality examination and participative and shared leadership).</td>
<td>The results indicate a significant finding which linked leadership effectiveness to asynchronous VFL usage and communication. (Structural causality examination and participative and shared leadership).</td>
</tr>
<tr>
<td>Kittmoller &amp; Laurenc, 2013</td>
<td>To examine the effects of culture, shared language, community, and media on knowledge sharing.</td>
<td>General agreement that face-to-face communication was the optimal solution for sharing of exquisitive knowledge if the VFL included members with different cultural and linguistic backgrounds.</td>
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<td>General agreement that face-to-face communication was the optimal solution for sharing of exquisitive knowledge if the VFL included members with different cultural and linguistic backgrounds.</td>
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</tbody>
</table>
### A.3 Classification Scheme

<table>
<thead>
<tr>
<th>General information</th>
<th>Virtual tool</th>
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</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>Video</td>
</tr>
<tr>
<td>Publication year</td>
<td>Telephone</td>
</tr>
<tr>
<td>Journal</td>
<td>Email</td>
</tr>
<tr>
<td>Time dimension</td>
<td>Instant message</td>
</tr>
<tr>
<td>Cross-sectional</td>
<td>Forum/Bulletin</td>
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<table>
<thead>
<tr>
<th>Research strategy</th>
<th>Measured Outcome</th>
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<tbody>
<tr>
<td>Survey research</td>
<td>Perceived effectiveness</td>
</tr>
<tr>
<td>Literature study</td>
<td>Decision quality</td>
</tr>
<tr>
<td>Meta-study</td>
<td>Communication Quality</td>
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<tr>
<td>Single case study</td>
<td>Task Score</td>
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<tr>
<td>Multiple case study</td>
<td>Performance</td>
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<table>
<thead>
<tr>
<th>Data collection</th>
<th>Data analysis</th>
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<td>Experiment</td>
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<tr>
<td>Focus group</td>
<td>Quantitative</td>
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<tr>
<td>Interview</td>
<td>Mixed Methods</td>
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<tr>
<td>Literature review</td>
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<td>Observation</td>
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<td>Questionnaire</td>
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<table>
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<tr>
<th>Team Type</th>
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<tbody>
<tr>
<td>Student</td>
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<td>Professional</td>
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### A.4 PRISMA Systematic Literature Review Checklist (Moher et al., 2009)

<table>
<thead>
<tr>
<th>Section/topic</th>
<th>#</th>
<th>Checklist Item</th>
<th>Reported on page #</th>
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<tr>
<td><strong>TITLE</strong></td>
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<td>Title</td>
<td>p. i</td>
</tr>
<tr>
<td><strong>ABSTRACT</strong></td>
<td></td>
<td>Structured summary</td>
<td>p. vii</td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td></td>
<td>Rationale</td>
<td>p. 1-3</td>
</tr>
<tr>
<td><strong>METHODS</strong></td>
<td></td>
<td>Protocol and registration</td>
<td>p. 28</td>
</tr>
<tr>
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<td></td>
<td>Eligibility criteria</td>
<td>p. 28</td>
</tr>
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<td>Information sources</td>
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<td>Search</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Study selection</td>
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<td>Data collection process</td>
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<td>Data items</td>
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<td>Risk of bias in individual studies</td>
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<td>Summary measures</td>
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<td>Synthesis of results</td>
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<tr>
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<td>Risk of bias across studies</td>
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<td>Additional analyses</td>
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<tr>
<td><strong>RESULTS</strong></td>
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<td>Study selection</td>
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<td>Study characteristics</td>
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<td>Results of individual studies</td>
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<tr>
<td></td>
<td></td>
<td>Synthesis of results</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk of bias across studies</td>
<td>p. 32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Additional analysis</td>
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</tr>
<tr>
<td><strong>DISCUSSION</strong></td>
<td></td>
<td>Summary of evidence</td>
<td>p. 35</td>
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<tr>
<td></td>
<td></td>
<td>Limitations</td>
<td>p. 47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conclusions</td>
<td>p. 46 &amp; p. 47</td>
</tr>
<tr>
<td><strong>FUNDING</strong></td>
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<td>Funding</td>
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</tr>
</tbody>
</table>

**Description:**
- **TITLE**: Identify the report as a systematic review, meta-analysis, or both.
- **ABSTRACT**: Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.
- **INTRODUCTION**: Describe the rationale for the review in the context of what is already known.
- **METHODS**: Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.
- **RESULTS**: Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
- **DISCUSSION**: Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).
- **FUNDING**: Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.
APPENDIX B – INCLUDED STUDIES REFERENCES


REFERENCES


