SOCIAL MEDIA IN MANUFACTURING WORKPLACES

BY

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DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Education Policy, Organization and Leadership
with concentrations in Human Resource Development and Learning Design and Leadership
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2018

Urbana, Illinois

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Abstract

This research study and dissertation was designed to evaluate any connection between the use of social media for learning, communication and collaboration in a manufacturing environment and improved performance in quality and delivery metrics in those organizations. As the competition throughout the world becomes more challenging, organizations, small and large, are changing the way they conduct business to remain competitive in the growing and changing marketplace. Many of these organizations are experiencing a continually growing sector of their employees working remotely or in, in some cases, other areas of the world. Many of these organizations are finding that the ways to perform and improve processes that had been relied upon for many years simply do not work in the current workplace. One way that has been discovered to improve performance with consideration to these challenges is through the use of social media. Social media is becoming increasingly more commonplace in the workplace in recent years. For several years, social media has been used by organizations to collect feedback from customers, employees and others to help refine their processes and products to improve their product or service to help make more satisfied customers. Coupled with increasing demands of Just In Time (JIT) manufacturing and increasingly rigorous quality requirements, social media is now being examined to be a means to help better equip and empower these workforces. Effective and consistent training can be a considerable challenge in many manufacturing organizations and many of those businesses are beginning to more fully understand the true impact of training. While the ROI may not always be easily quantifiable in many instances, training and development is becoming a cornerstone of many organizations.

Although most employee development / training departments desire to make training better, barriers such as off shifts, departmental budgets and remote working employees can challenge

even the best plans or intentions. Because of the inconsistent training that occurs as a result of these factors, organizations can experience varied outcomes that can dramatically impact customer satisfaction, employee engagement and organizational profitability. Training through the use of social media can help reduce the burden placed upon these organizations and lead to a more positive financial performance. It can also allow organizations to use a web based venue that is accessible nearly anywhere in the world and be accessed nearly instantaneously. In addition, many of these social media sites can be used from little to no cost, helping to better control costs that are associated with employee development. Although the use of social media for employee development is new, the results of this research study shows promising results.

This research study shows a correlation between the use of social media for learning, communication and collaboration and the organization's improved performance in quality and delivery metrics. While the Pilot Study produced positive results, the scope of this earlier study was broad, using a number of social media venues, and there was no way to completely understand where the positive effects came from. In an attempt to better control the variables in the empirical research study, the number of forms of social media used in that study was reduced to only the use of Twitter. The results of the research study were also positive yet did not show as large of an impact as the Pilot Study. This could be due to the many factors and allows for significant opportunity for future research using other forms of social media alone or in combination with one another. In addition, the results from the anonymous online survey showed that the majority of the participants found value through the use of Twitter for communication and collaboration within their workplace. Although these results are promising, there is a great deal of opportunity to explore this relationship in much closer detail opening up a venue for future research.

“Through others we become ourselves.” - Lev S. Vygotsky

“People with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided.” – Albert Bandura

Acknowledgements

There are no words that can adequately describe the thanks I have for allowing this work to be completed. Inevitably, I will fail to mention someone but that is not an indicator that his or her contribution was any less important. In some cases, this lack of acknowledgement is a reflection of the silent support that has always been present before, during and remains after this work was completed.

As a nontraditional student, I have worked on my education as a working adult, husband and father. There is no doubt that there has been a significant amount of time invested that could have been easily made into family time. I am fortunate as my wife and daughter understand and could see the passion I had for learning and rather than resent the time invested in this process as a burden to the family, they were both very supportive and encouraging. I have missed several of the swim meets and other family functions as I worked to complete this research study and it was clearly a sacrifice for all of us in the family. As my daughter reaches the time of beginning her own college level education, I hope that she can see that while the path I took was not an easy one, I was able to navigate it with the help and guidance of others and keeping focused on the end result. She has always pushed herself in academics and swimming and I know this desire to better herself through work will pay off as an adult. Real satisfaction comes from pushing our own limits and working towards something larger than ourselves.

My committee members, Dr. William Cope, Dr. Mary Kalantzis, Dr. Matthew Montebello and Dr. Denice Ward Hood provided much helpful advice and generous support for this project. Each was a vital part of this committee and was gracious with their help and the support of this work. Although Dr. Cope received the brunt of the emails and communication from me, all were supportive and offered leadership as I worked through this process. This work would not have been possible without the help from each of you and for that, I am forever

indebted. I particularly want to thank Dr. Mary Kalantzis, Dr. Matthew Montebello and Dr. Denice Ward Hood for stepping in and becoming a part of the committee at such a late stage of the work and offering such valuable insights to make this research truly extraordinary. For many months, I felt like I was lost in a forest and the committee came in and offered guidance for me to make it out of the darkness. The research was suffering and so was I as a researcher. The value of the work did not seem clear and without that, I lost passion in the work. I came to a point when I was willing to toss in the towel; however, this committee showed me that the work was important and helped me regain the passion that I had lost. The entire committee offered expertise, experience and advice that allowed me to see a much larger picture and push myself to truly explore the work I was doing. Through them, I also found myself maturing as a researcher and colleague of theirs and how we were working towards creating knowledge and not simply completing a degree requirement. Prior to that epiphany, the committee was "them" and I was working on "my" work. Now, I see the committee and me as a collaborative team adding to the collective knowledge of the world, not just work towards a university degree. The research that was completed is cutting edge and hopefully many others will find value in it. My belief is that we have identified areas that are largely ignored although the results can have a profound impact on manufacturing and the profitability of the organizations involved. The phrase, "You don't know what you don't know" was far too relevant in this case and I have learned a great deal through this process. Without the committee pushing me to explore farther and drill down deeper into this work, much of the data and results contained in this research study would not exist. It was this "extra" research that really adds the relevance and completeness to the work that was originally envisioned. For that, I am excited and thankful for each of them. Thank you!

TABLE OF CONTENTS

GLOSSARY. viii

CHAPTER 1- INTRODUCTION. 1

CHAPTER 2—REVIEW OF LITERATURE 18

CHAPTER 3—METHODOLOGY 70

CHAPTER 4—EMPIRICAL STUDY 92

CHAPTER 5—RESULTS 112

CHAPTER 6—DISCUSSION AND FUTURE RESEARCH 152

REFERENCES 180

APPENDIX A-CONSENT FORM. 196

APPENDIX B-PILOT STUDY IRB APPROVAL 200

APPENDIX C-RECRUITMENT EMAIL 201

APPENDIX D-ONLINE ANONYMOUS SURVEY 203

APPENDIX E-RESEARCH STUDY IRB APPROVAL 204

APPENDIX F-RESEARCH STUDY RECRUITMENT E-MAIL 205

APPENDIX G-RESEARCH STUDY CONSENT FORM 208

APPENDIX H-OPEN ENDED SURVEY RESPONSES 212

APPENDIX I-WORD CLOUDS 217

APPENDIX J-HIERARCHY TABLES 220

GLOSSARY

- **Cognos** – IBM Software that is a real time system that is linked to the corporate-wide scheduling system. “Cognos develops, markets, and supports two lines of software tools that are designed to satisfy business needs for the extended enterprise within traditional and eBusiness markets” (Company Spotlight: Cognos, 2004).
- **Formal Learning** - It is “always organized and structured, and has learning objectives. From the learner’s standpoint, it is always intentional: i.e. the learner’s explicit objective is to gain knowledge, skills and/or competences. Typical examples are learning that takes place within the initial education and training system or workplace training arranged by the employer. One can also speak about formal education and/or training or, more accurately speaking, education and/or training in a formal setting” (OECD, 2014).
- **Informal Learning** -Although there are many definitions for this term, Livingstone defined it in this way: “Informal learning is any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria” (2001, p. 5).
- **MRDR** – Organization X’s proprietary software - Material Rejection & Disposition Report.
- **On The Job Training** –Matsuo and Nakahara (2013) describe this form of training as “the process in which new knowledge is acquired, shared, institutionalized and discarded, formally, informally and incidentally in the workplace” (p. 197).
- **OTD%** - On Time Delivery Percentage – Reported in %. This number describes the delivery performance of whatever is being measured. 100% is desired.

- **PPM** – Parts per Million – A quality assurance term used to capture the quality performance in terms of parts of rejections per million. 0 PPM is desired.
- **Social Learning** – The theory and process in which individuals observe the behavior of others and its consequences, and modify their own behavior accordingly. “Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action.” (Bandura, 1977).
- **Social Media** – Various forms of electronic communication such as social networking, social networking and blogging websites where online communities can be used to share ideas, information and other electronic content. ‘‘Social media’’ can be generally understood as Internet-based applications that carry consumer-generated content which encompasses ‘‘media impressions created by consumers, typically informed by relevant experience, and archived or shared online for easy access by other impressionable consumers’’ (Blackshaw, 2006, p. 2).
- **Workplace Learning** – Any learning that takes place that allows an employee to be able perform their job related needs more effectively. This learning may occur at the workplace or other locations. This kind of learning can also use a number of forms and methods involving formal and informal means. According to Garavan et al. (2002), workplace learning represents a set of processes that occur within specific organizational contexts and involve acquiring and assimilating integrated clusters of knowledge, skills, values and feelings that result in fundamental changes in the foci and behaviors of individuals and teams (p. 61).

CHAPTER 1

INTRODUCTION

The continued expansion of the Internet is transforming markets and workplaces worldwide. Currently, "approximately 3 billion people worldwide have access to the Internet – equal to 43 percent of the world's population, according to the United Nations' International Telecommunication Union, which noted the rapid expansion of mobile broadband as well" (Risen, 2015, p.1). In the past decade, the world has experienced a slow growth in some economies, though much more rapidly in others but as Risen continues, "However, the Internet business has grown faster than any other sector in the U.S., having boosted its employment by 107 percent between 2007 and 2012 while many other industries in the U.S. were shedding jobs under the weight of the Great Recession" (2015, p.1). To better compete in the growing global marketplace, suppliers are changing their methods of doing business. "The explosion of digital connectivity, the improvements in communications and the enforced global competition are revolutionizing the way business is performed" (Angela & Liana, 2008, p. 763) and organizations are developing their employees to be better equipped to address the needs of this larger, worldwide economy. "In this new landscape, knowledge constitutes the most important factor, while learning together with the increased reliability and trust, is the most important process" (Lundvall & Johnson, 1994, p. 26). "These trends suggest that private and public organizations have to reinvent themselves in order to achieve strategic competitive advantage" (Angela & Liana, 2008, p. 764).

As organizations transform to address these demands, costs must be controlled and production methods must be refined. "Organizations that are competing successfully in the global marketplace are driving their quality and manufacturing processes to improve. Those

organizations that do not implement these kinds of changes often see a significant decline in their position and performance in the marketplace" (Goetsch & Davis, 2014, p. 10). Since current demands for excellence and delivery performance allow little room for error, organizations must address these needs or face potential failure as a supplier. Many organizations attempt to satisfy these needs through their employee development/training program but some have found that the training methods that have been relied upon for many years are now becoming increasingly ineffective. "The majority of current corporate training programs are weak, ineffective, costly, and inconvenient. New training programs provide steps and strategies proven to excite employees, make them want to learn, and decrease training costs while increasing productivity (Schank, 2012, p.4).

Not understanding this shift in employee development can lead an organization to use additional resources on training and development that may not be able to deliver the results that will make them attractive to customers in the global marketplace. This unneeded expense combined with employees who may not be developed to perform at the highest levels can make some suppliers unable to compete with those who implement effective changes to their training / employee development programs. Ultimately, the success of any employee development program will rely on the acceptance of the employees and their engagement in the learning strategies. Research conducted in 2008 showed that "system usefulness, ease of use, employee involvement, system reliability and customized training for employees" are critical factors for a training / employee development program to be successful (Rahim, p. 11). Making the training program more appealing to the employees will have significant influence on the success of the program.

Research has shown that students prefer to learn through informal means and methods

(Marsick & Watkins, 2015). Even with this knowledge, many organizations continue to invest significant resources into formal training. At the same time, there is constant pressure to measure performance and Return on Investment (ROI) of employee development programs. Interpreting ROI in a formal learning program can be much simpler whereas understanding this value of informal learning programs including those that use social media, can be difficult to quantify (Leong, Phillips, Giddens & Dickson, 2014). While the effectiveness of informal learning can be more difficult to measure than a formal learning system, it can be significantly easier to implement and encourages the involvement of the employees in their own development while simultaneously reducing overall costs associated with the employee development program. In these ways, Organizations can use modern resources more effectively, freeing up resources for other areas of the organization and making them more competitive in the marketplace reducing overall costs for their learning program, helping to produce a more favorable bottom line financially.

Today, there are many avenues for informal social learning in the workplace, whose presence is traceable to the numerous social learning platforms available now (i.e. reading job related help aides on social media, communicating with a peer or supervisor via email, video conference, or real-time chat, observing the opinions of others in a social forum, receiving mentoring from a supervisor or coworker, etc.). This form of learning is often implemented at a low to no cost to the organization. Soumitra Dutta (2010) explains how

> today's leaders must embrace social media for three reasons. First, they provide a low-cost, highly accessible platform on which to build your personal brand and to leverage the resources for learning within their organization. Second, they allow you to engage rapidly and simultaneously with peers, employees, customers, and

> the broader public in order to leverage relationships, show commitment to a cause, and demonstrate a capacity for reflection. Third, they give you an opportunity to learn from instant information and unvarnished feedback". (p. 127).

The use of social media can reduce costs while simultaneously opening up a broad network for feedback and support that can be used to improve business processes. In comparison, formal learning systems (instructor-led training, self-paced online learning modules, etc.) can be quite costly, both in implementation and management. Many of the tools and resources used in formal learning "may be too expensive to produce (requiring multiple resources and skills) than many organizations can afford to expend" (Singh, 2003, p. 52). In contrast, informal social learning can usually be found nearly everywhere; it is elusive but powerful. It can be used in a wide spectrum of ways and the benefits are many.

For several years, social media has been used in many organizations to facilitate communication, either within an organization or in an outward means to market the organization to the general public. One area where social media has recently been seeing an expansion in its use is for employee development through social learning. Research shows that the use of social media for learning is being embraced by many organizations.

> The vast impact of Social Media on private interaction and economic behavior is an undisputed fact. In the corporate sector, Social Media tools specialized on employee's needs and communication, are called Enterprise Social Networks (ESN) and are increasingly found to be applied. One of ESN's important functions is that employees can learn from each other – implicitly. While the established ESNs have already a positive impact on better work organization

> (communication and administration), the potential of "social learning" within and through ESNs has hardly been addressed or tapped. It is just recently that in some ESNs the notion of social learning as an integrated element of human resources development has been addressed and a number of solutions field tested. (Zinke, Meyer, Friedrich, & Reif, 2017, p. 3).

To more effectively deal with the learning needs within organizations, social media is increasingly being used to fulfill knowledge management needs. Zhang, et al. describes how

> Social media is bringing great challenges and wonderful opportunities for organizational learning. With support of social media, organizations may facilitate the knowledge management process within firms (e.g., knowledge sharing), then to encourage employees to promote collaborative learning behaviors from e-learning to social learning. (2016, p. 803)

Through the use of social media, social interaction between users increases in a variety of ways and avenues. Ahlqvist, et al. states "Social media is the social interaction among people in which they create, share or exchange information and ideas in virtual communities and networks" (2008, p. 13). Through this exchange of information, organizations can experience an increase of information available for knowledge management though social learning.

Bandura explains how social learning can be empowering in how we learn because without it

> learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling:

> from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action. (1977, p. 33).

As research has shown, many organizations use social learning to empower their workforce and often the employee may not even be aware that learning is taking place (Bennett, 2009; Wilkins, 2008). It is this embedded way of transferring knowledge that makes it so useful and desirable to many organizations (Ashford & LeCroy, 2010). What once was often a wearisome task, employee development is beginning to be a welcome part of the daily work life as a result of social learning through new communication channels. Because of this expansion of social learning through the use of social media, technology manufacturers are responding by developing more powerful tools to help enable learning, including faster and more portable devices as well as software applications and smart technology applications to use with those devices (Thomas & Akdere, 2013). The way we work, both physically and interactively through the mediation of communications technologies, is changing at a dramatic pace. Organizations are changing, too (Dearborn, 2013). This change in how we work, interact and learn also nurtures employees who are more capable of delivering higher performance for the organization while finding greater job satisfaction and self-confidence in their jobs. Unfortunately, not all employees are able to enjoy these kinds of positive experiences in the workplace.

In America alone, only 30 percent of employed individuals are happy with their jobs (Foley & Lytle, 2015, p. 203). That statistic indicates that the vast majority of individuals is emotionally disconnected from their work and sees their position in the workplace as a means to satisfy financial obligations rather than fulfill a passion that may also align with organizational goals. Social learning strategies and using peer-to-peer communications platforms can help to

change this situation. When employees are given opportunities to connect and collaborate with peers and are released from schedules packed with formal learning activities, creativity often ensues, as does job satisfaction and engagement (Peng & Mao, 2015). Social learning is more flexible than formal learning and is usually much more cost effective than traditional learning methods. It encourages engagement and participation, and improves collaboration between employees and different sectors of an organization, driving a productive momentum for the organization that is more clearly operating much more in unison (Tabvuma, Georgellis & Lange, 2015). When employees feel empowered, they often have a higher self-confidence in their ability to perform the work they have been assigned in the workplace. Bandura (1977) stated how this self-confidence in their ability can have a dramatic impact on how they perform in the workplace. "People's judgments (i.e. memories, beliefs, preferences and self-perceptions) of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 48). Employees who have a higher level of confidence tend to perform at higher levels within their organizations leading to higher productivity (Blacksmith & Poeppelman, 2016). This performance improvement benefits the employee on a variety of levels and also serves the organization as a whole, leading to fewer errors in their work and more products and services available to be delivered on schedule, leading to a positive impact on an organization's overall financial health, as well (Puijenbrock, Poell, Kroon and Timmerman, 2014).

Supporting the research and theory of Albert Bandura, the introduction of social media has changed the social interaction and human experience in education and in the workplace. Employers now have a new opportunity to apply the concepts of Bandura's Social Learning Theory toward enhanced employee engagement and development in a social media context.

Social media is now becoming one of the largest and most diverse platforms to facilitate social learning.

> The use of new technologies, especially social media, is becoming increasingly ubiquitous in learners' daily lives. Free or inexpensive apps distributed through app stores have given rise to a social-media-focused culture that is shaping how we should communicate, teach, and learn (Mao, 2014, p. 213).

These tools have never before been available to facilitate this kind of learning in ways that present possible today. Bandura's theory, from the pre-social media age, was ambitious and idealistic. Today, the ideals do not need to change; lateral, peer-to-peer social learning may simply become more practicable with fewer boundaries while offering more support for the learner. Although the list is not all-inclusive, Facebook, Twitter, and a variety of other services are now synonymous with platforms that allow daily interactions to take place, and for the first time in human history, the entire world is truly interactive—compared at least to the centralized models of mass media and hierarchical organizational command structures. Social media technologies have profoundly changed the way that social interaction occurs within our world. "Users now have access to social media content and expanded interactions that have not been available before. These interactions are possible via highly accessible Web-based technologies" (Bertot, Jaeger& Grimes, 2010, p. 266).

In addition, these connections allow organizations to modify their performance and enhance customer satisfaction through feedback gained through social media. "As firms look to forge stronger connections with their customers in a competitive marketplace, the use of social media tools can dramatically influence firm performance through customer engagement and the value created from customer interactions" (Rapp, et al, 2013, p.547) Social media is enriching

cognitive processes central to effective workplace participation, including attention, memory, and motivation. If organizations can employ the possibilities of social media, social learning factors may improve, and subsequently, impact their overall productivity and financial health. Organizations should embrace this changing paradigm, allowing employees to use this vast "knowledge exchange" on the world's digital stage to benefit their employees and themselves.

As a result of the lack of relevant prior research that directly aligns with the use of social media in the manufacturing workplace used for communication and collaboration, the Pilot Study was found to show a correlation between the use of social media and quality (PPM) and delivery metrics (OTD%) but clearly identifying the source of the correlation was problematic due to the use of multiple forms of social media. Because of the findings from the Pilot Study, the research (Empirical) study was modified to reduce variability in the experiment to a single form of social media (Twitter). Although the changes were small, the research questions associated with the Pilot Study and Empirical Study are slightly different. In addition, because of the findings in the Pilot Study, the use of an anonymous, online survey was introduced for the Empirical Study to help further understand the relationships between the use of social media and quality and delivery performance. Without the survey, there would be a significant amount of information that was open to interpretation.

Statement of the Problem

Effective and consistent training can be a considerable challenge in many manufacturing organizations. Although most employee development / training departments desire to make training better, barriers such as off shifts, departmental budgets and remote working employees can challenge even the best plans or intentions. Because of the inconsistent training,

organizations can experience varied outcomes that can dramatically impact customer satisfaction and organizational profitability. As social media gets a stronger foothold in society, many organizations are finding its use to be very effective to fill some of these gaps in their employee development / training programs. Although its use in this manner is still fairly groundbreaking, promising results from the limited research that does exist on this subject is empowering other organizations to explore this tool for their own use. Many of the social media platforms can be used at no cost and as a result of the proliferation of smart phones in society, employee development can now be completed when and where the employee is instead of being forced to succumb to the limitations current programs can have. One type of organization that has not experimented a great deal with the use of social media for training is manufacturing. In the United States alone, there are over 13 million employees engaged in manufacturing work (Bureau of Labor Statistics, 2018). This is a very large group of employees that could benefit from more effective and consistent training through social media.

The empirical site upon which this researcher will report is a manufacturing enterprise. The focus will be social learning through the use of social media in this workplace. By way of organizational context, manufacturing is becoming increasingly competitive in the global economy. From the point of view of human capital, organizations must hone their training / employee development programs to continue to be successful. Although there is a growing body of research involving social media for learning, there have been very few studies conducted that explore how social learning can influence quality and delivery metrics in manufacturing. Global competition is fierce in most workplace settings and traditional instructor or materials-centered training methods are becoming increasingly ineffective to adequately equip organizations to compete. Social media used for learning in the workplace can address many of these training

needs. This relatively new method of learning is still greatly misunderstood. The current literature does not sufficiently address how this kind of learning can relate to productivity and delivery in a manufacturing environment. Understanding the relationship between the use of social media in learning and employee development in the workplace and the performance of an organization will help empower many of these organizations to be more competitive in the ever growing global marketplace.

Hypothesis

The research hypotheses for this study are: H(1) the use of social media in manufacturing can have a positive effect upon quality performance of an organization; and H(2) the use of social media in manufacturing can have a positive effect upon delivery performance of an organization.

Research Questions

Research Question 1: To what extent does the use of social media for informal workplace learning affect nonconformance (internal and external) metrics of this organization?

- **Null Hypothesis:** The use of social media for informal workplace learning had no effect on nonconformance (internal and external) metrics of this organization.
- **Alternate Hypothesis:** The use of social media for informal workplace learning had an effect on nonconformance (internal and external) metrics of this organization.

Research Question 2: To what extent does the use of social media for informal workplace learning affect on time delivery (OTD%) metrics of this organization?

- **Null Hypothesis:** The use of social media for informal workplace learning had no effect regarding on time delivery (OTD%) metrics of this organization.
- **Alternate Hypothesis:** The use of social media for informal workplace learning effected on time delivery (OTD%) metrics of this organization.

Significance of Study

This study will be aim to understand the relationship between the use of social media for learning in a manufacturing organization and its quality and delivery performance while contributing to the body of knowledge available for future research. It also has practical implications in the workplace as this research will also be beneficial to many organizations who struggle to maintain a competitive edge in an increasingly challenging global economy. Employees, supervisors, management, human resources and top executives of nearly any type or size of organization could benefit from the findings that I anticipate may emerge from this research. The focus of this study is significantly different from prior studies involving social media for learning to the extent that it will be focused on specific manufacturing metrics. In this study, I aim to show how the use of social media for informal workplace learning may influence organizational performance metrics.

Moreover, this research will provide recommendations on how future research to better understand what sources of social media contributed the most (and least) to overall organizational performance. Furthermore, this study will be helpful to the manufacturing industry by communicating important considerations in the area of human resource development, organizational objectives, and strategies. It will also serve as a future reference for researchers on the subject of human resources and corporate performance. Finally, this research will aim to

influence the thinking of the manufacturing community about the changes involving social media and its value of in training /employee development.

Context of Study

Currently, in the manufacturing setting where this study will be conducted, work related learning can be random and produce a number of outcomes depending on the circumstances and people the trainee are working with. In this organization, resources for the trainee are limited leaving the employee somewhat helpless and at the mercy of the trainer that was chosen for their professional development. Learning through the use of social media can offer these trainees a valuable and constant resource to help them achieve the levels of excellence that is needed in their workplace. As technology and resources continue to develop allowing for low cost yet effective learning using social media, some organizations have already moved to using this form of knowledge transfer in their workplaces (Karyotakis & Moustakus, 2016), while and other organizations are moving in that direction (Peng & Mao, 2015). With the rapid expansion of this form of social learning, organizations are challenged to stay current with the changes that are happening in technology that affect the methodologies for and processes of delivery of this form of employee development. Current research into social learning and the use of social media has been focused primarily in education and very little study has been completed involving its use in the workplace (Foley & Lytle, 2015; Gerhardt, 2014; Hallinger, 2003; Kelly, 2014). Although the study of the use of social media in the workplace has been slowly advancing, virtually no research has been completed comparing its use and the effect on quality and delivery metrics in manufacturing. Although research into the correlations between employee development and company performance has been completed, there are a number of gaps in the research, and particular, empirical evidence of the relationship of social learning using social media and the

competitiveness of the manufacturing workplace. Continued research into these developing areas is necessary to increase awareness of the risks and benefits of social learning through the use of social media in the workplace.

The research to be completed investigates the relationship between the implementation and use of social learning though social media and the effects on quality assurance metrics (in the form of internal and external rejection rates) measured in parts per million (PPM) and on time delivery % (OTD%). This research will add to the body of knowledge that members of the manufacturing community can reference to improve their processes and training programs within their own organizations. Since there is such a small amount of research available in this area of employee development and the manufacturing workplace, the conclusions drawn from this research could have a significant impact on the financial standings of other similar organizations.

Not only will this study contribute to a body of knowledge; it will also have practical implications. The focus of this study is somewhat different from prior studies as it attempts to fill a void in the relationship between social media for learning in the workplace and quality and delivery metrics. The goal is to develop a better understanding by determining under what specific conditions it will be easier for employees to collaborate by sharing knowledge and to apply this knowledge to make positive changes to the workplace. The results will benefit organizations who desire to implement social media for learning in their organizations. Before an organization invests funding and time into a training or employee development program, it is important that it is able to anticipate and account for the factors that may influence the successful outcome of the program. This research can serve as a foundation to help make more informed choices in these investment decisions.

Overview of Results from Pilot Study and Research Study

This study successfully showed a relationship between the use of social media in the workplace and its effects on manufacturing metrics including quality performance (PPM) and on time delivery performance (OTD%). The Pilot Study showed a strong relationship that yielded very positive relationships between the two aforementioned variables but also utilized a large number of social media venues making any relationship between the use of social media and the performance results difficult to interpret. Because of this difficulty, there was little confidence in understanding of what one (or combination of multiple) social media venue(s) actually contributed to the improvement observed in the quality and delivery performance. As a result, the later, Empirical Study, reduced the number of social media venues used to one (Twitter for communication and collaboration) to help eliminate the confusion experienced in the Pilot Study. The Empirical Study did reveal that when the employees communicate and collaborate through the social media platform (Twitter), its use allowed them to operate in a more accurate and timely manner, achieving more satisfactory performance results identified as critical success factors in that business unit. While improvements in quality and delivery performance was observed in the Empirical Study, it was at a lower level than those observed in the Pilot Study, indicating that other venues of social media likely contributed to the difference experience in workplace performance. These differences indicate that there is opportunity for significant future research available in this relatively unexplored area of employee development to better understand if a single or combination of social media tools would deliver the best performance in the workplace.

Combined with the Empirical Study outcomes, the results of the online, anonymous survey showed that the use of social media could lead to positive performance changes in the

workplace while engaging the employees at a level that may not be available without this form of communication and collaboration. The survey responses also revealed that some employees were not enthusiastic in the use of Twitter for use in the workplace, however, the vast majority of participants of the study enjoyed and embraced the use of social media for workplace needs. This embracing of the use of Twitter by the employees who partook in the Empirical Study could indicate that the use of social media, in the form of Twitter or other, could also help to increase employee engagement while making the manufacturing process more efficient.

Synopsis of Following Chapters

Chapter 2 is a review of current literature of topics that apply to this research study. Relevant research regarding social learning theory, social media use in the workplace, the relationship between workplace learning and organizational performance and the relationship between quality and delivery and organizational performance were reviewed in great detail offering a foundation from which the research could move forward and build from. Special attention was given to literature regarding social media, workplace learning, social media in the workplace, effects of training on workplace performance and effects of quality management systems on workplace performance.

Chapter 3 describes the exact steps that will be undertaken to address the hypotheses or research questions stated in Chapter 1. Chapter 3 will follow a logical path to address the statement of the problem in much the same way as research questions follow from the Review of the Literature. The goal of this chapter is to provide a clear and complete description of the specific steps to be followed. Due to findings that had been discovered during the pilot study,

Chapter 3 has two main sections describing these steps to ensure that the reader can replicate the steps used in the Pilot Study and the subsequent Research Study.

Chapter 4 will show the results of the Research Study in detail. The results section is to report the findings of the study based upon the methodology described in Chapter 3 that was applied to gather information from the study. The results state the findings of the research arranged in a logical sequence without bias or interpretation. This section is a premise to Chapter 5, the Discussion chapter.

The purpose of the discussion in Chapter 5 is to interpret and describe the significance of the findings in light of what was already known about the research problem being investigated, and to explain any new understanding or insights about the problem after taking the findings into consideration. The discussion will connect to the introduction by way of the research questions or hypotheses that were posed in the Literature Review in Chapter 2, and explains how the study will affect the overall understanding of the research problem considering the results of the research study and any affects it may have on this research work of future research work. In this chapter, the research questions will be answered as supported through the use of the results of the research study and will attempt to connect how this research fits into and interacts with the current body of knowledge of the subject.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this study was to examine the relationship between the use of social media for workplace learning and the effect on quality and delivery performance in a manufacturing environment. An extensive literature review indicates a lack of systemic research in this area and as a result, many related areas were reviewed to build a foundation and overall understanding of the components of the study. Due to the gap in current research that directly looks at these relationships specifically, the literature review looks at each component and how they interact with one another. The first area examined investigates how and if the activities that are part of the social learning theory would be present in a social media forum. This followed by a close examination of how social media affects the workplace, specifically in workplace learning. Ultimately, I want to examine how the use of social media for workplace learning would affect the quality and delivery performance of a workplace. These two metrics (quality and delivery) can have a profound impact of the success of a manufacturing organization and knowledge of how they can be impacted by social media use would offer guidance to other organizations looking to improve their workplaces.

The body of this review is organized into four main sections: Social Learning Theory; Social Media in the Workplace; Relationship between Workplace Learning and Organizational Performance; and Relationship between Quality and Delivery and Organizational Performance. The second section, Social Media in The Workplace, includes three subsections; Risks Associated with the use of Social Media in the Workplace; and Social Media for Workplace Learning and Employee Development and Twitter for Workplace Learning. Below is a flowchart showing the relationships between the topics that were reviewed for this study.

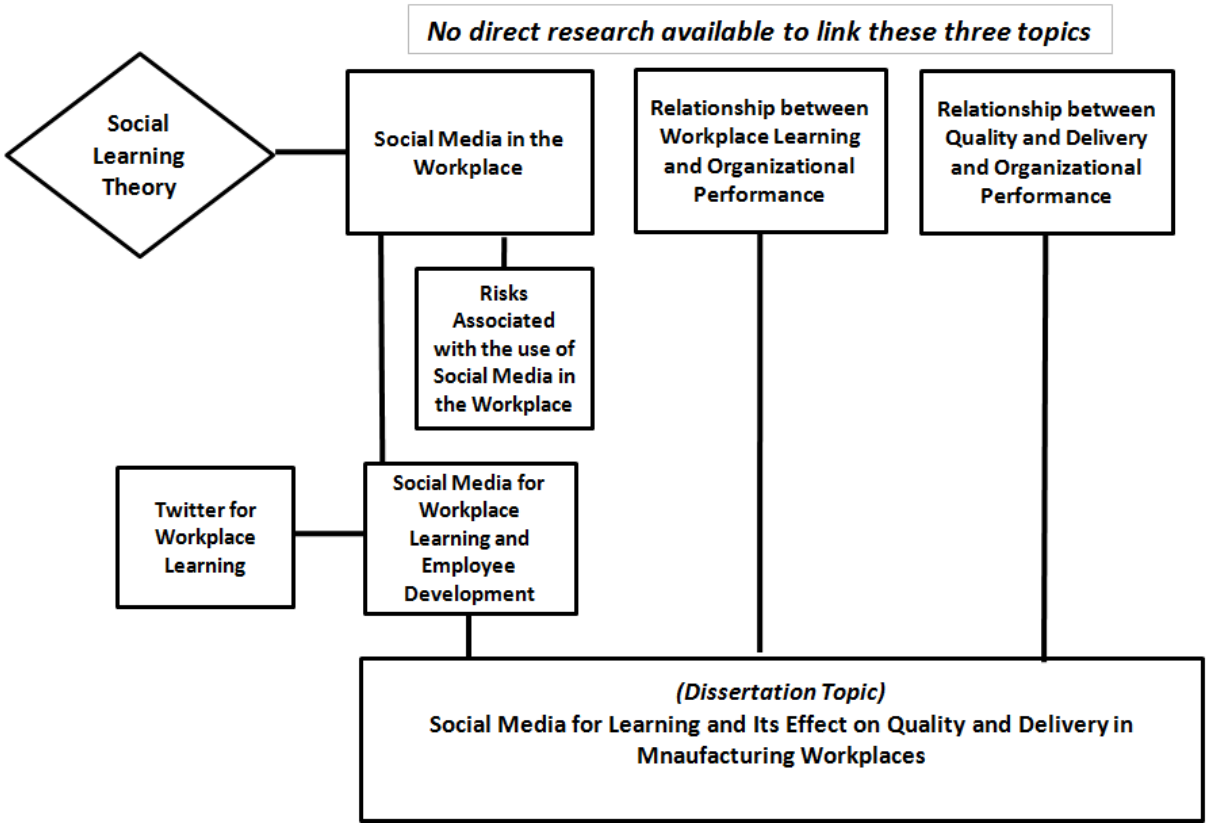


Figure 2-1

In the conclusion of this chapter I summarize how these various components relate to my research.

Introduction

"Humans are social creatures who rely on feedback from fellow humans to determine their own existence" (Jonassen & Land, 2012, p. ix). Much of the learning each of us is exposed to throughout life is completed through social means. Albert Bandura described this phenomenon in his social learning theory long before the emergence of technologies and cultures of social media. These modern resources add a new dynamic to the theory not originally envisioned, yet consistent with its general principles. Through the use of social media, social learning has taken on a much different appearance than before while continuing to support Bandura's theory. As technology and social media platforms continue to expand into society,

organizations and individuals are finding new and exciting use for these tools, including learning.

> Overall, research suggests that social media are being increasingly used as tools for developing formal and informal learning spaces or experiences that start out as an individual learning platform or Personal Learning Experience (PLE), enabling individual knowledge management and construction, and evolve into a social learning platform or system where knowledge is socially mediated. (Dabbagh, N., & Kitsantas, A., 2012, p. 5).

It would be only a matter of time before social media use would find its way into the workplace to satisfy many organizational needs. Although there are some risks associated with its use, the benefits are usually far greater and outweigh the potential threats. As the Internet has made the world seem more closely interconnected, it has also made global suppliers more competitive as they vie for international business. As a result of this competition between suppliers, organizations have been making changes to the way they conduct business to remain viable. "Global competition and changing business environments require companies to innovate, improve, and learn continuously to develop better processes and offer compelling value propositions" (Lüdeke-Freund, Freudenreich, Schaltegger, Saviuc, & Stock, 2017, p. 188). Change is inevitable and it was only a matter of time before the way businesses would be changed. "Groups are always moving, always fluid, always in a state of dynamic and unstable change. And we social actors do not necessarily remain content to leave differences the way they are" (Kalantzis & Cope, 2016, p. 92). One of those changes is the use of social media use in the workplace. Its use has been increasing in many organizations but recently, social media has begun to be used for something significantly different as it serves as a portal for workplace

learning and employee development. By using social media for learning in the workplace, employees are being empowered to help enable an organization have the best chance to perform at a level that can keep them profitable and competitive in an ever changing global economy. Although there are conflicting research results in regard to the use of social media in the workplace, there is great interest in this low cost and configurable learning platform. Even though these tools are not primarily designed to be used as a learning platform, their use in this research makes them a valuable tool from which employee development and workplace learning can take place. By addressing quality and employee competence, organizations are exploring the use of social media in the workplace to help revitalize their aging training programs to better position themselves in the global market.

Social media is increasingly being used for workplace learning in many organizations. In 2013, research conducted by Workforce.com showed that

> large employers are fueling increased adoption of social-learning tools, such as internal employee blogs, wikis and online expert communities. Enterprises with at least 10,000 employees spent an average of $46,000 on social tools in 2012, three times the average two years ago (Kranz).

With the relationship between having training and quality systems and the financial and productivity performance in an organization, many organizations would benefit from this kind of data to help them implement and manage these systems in their own organizations. Currently, there are significant gaps in research addressing the relationship between the use of social media for workplace learning and quality and delivery metrics in a manufacturing setting. These metrics are often the primary measures that can identify how a manufacturing workplace if performing. “Supplier attributes, such as product quality and ability to meet delivery

commitments, become primary performance measurements in manufacturing and are often used to select suppliers to be sourced for business needs" (Atkinson, Waterhouse & Wells, 1997, p. 25). Additional research to close these gaps would benefit a great number of manufacturers throughout the world as they compete in a fast growing and increasingly competitive global marketplace.

Social Learning Theory

According to Social Learning Theory, "people can learn by observing other persons (models) whom they believe are credible and knowledgeable. Social learning theory also recognizes that behavior that is reinforced or rewarded tends to be repeated. The models behavior or skills is rewarded is adopted by the observer" (Bandura, 1977, p. 24). Bandura continued by saying that people learn through observing not only others' behavior, but also their attitudes about the behaviors, and the results from those behaviors. "Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action." (Bandura, 1977, p.22). Social learning theory analyzes human conduct in terms of continuously shared interaction between cognitive, behavioral, and environmental stimuli. It has been beneficial in describing how people can learn unfamiliar things and to cultivate new behaviors through the observation of others, and eventually, imitating them. Results of research conducted by Bandura over several years support his earlier assumptions that learners are highly social in many ways and will mimic the activities that they are exposed to. Although the theory was originally observed through face-to-face (FTF) interactions, social learning is now a significant part of distance learning and learning through the use of social media.

In the early 20th century, the Behaviorism Theory was the predominant theory considered when planning employee training and development.

> Early learning theorists, such as B.F. Skinner – an influential psychological researcher, professor at Harvard University and recipient of the first American Psychological Association's Award for Outstanding Lifetime Contributions to Psychology – writing in the 1930's through the 1950's, believed that people learn only through behavior-based reward and punishment. Skinner's behavior based learning theory required workplace managers to establish individualized reward schedules to modify behavior (Brown, 2017)

Although the theory of behaviorism can lead to significant changes as a result of reinforcement or punishment, Bandura believed that behaviorism alone was not capable of explaining all that be observed and understood that behavior and the environment affected each other.

> Skinner's learning theory contrasted with another popular learning theory called cognitive learning theory. Cognitive theorists believed that learning was a passive activity occurring through observation. Albert Bandura, a Stanford professor, proposed a theory that combined attributes of behaviorism and cognitive learning theories. Bandura's theory stated that individuals can learn by observing the rewards and punishment received by others in addition to their own experiences. Bandura's observation learning theory was renamed social learning theory in 1977 and later called social cognitive learning, beginning in 1986 (Brown, 2017).

Bandura referred to this phenomenon of learning from one another through observation as reciprocal determination. It suggests that individuals function as a result of a dynamic and

reciprocal interaction among their behavior, environment, and personal characteristics. Personal characteristics include one's thoughts, emotions, expectations, beliefs, goals, and so forth. Behavior is conceptualized as a person's skills and actions and environment is considered to be a person's social and physical surroundings. All of these systems interact with one other; therefore, a change in one will likely influence the others. Reciprocal determinism indicates that people do have a say in their future, because of reciprocal interactions (Lee, 2005, p. 126). Because this is something very personal and configured to align with the particular way an individual learns, social learning should be flexible enough to facilitate broad and diverse needs among employees. This is especially true in small business environments where employees tend to work closely together and budgets for employee development is usually small.

While small businesses, like their larger counterparts, have used a spectrum of employee development approaches over the years, social learning is often the predominant form found in smaller organizations (Bingham & Connor, 2015). This phenomenon is often observed as a result of managers and employees developing their skills through normal workplace activities and daily interaction. Very often, employees in smaller organizations tend to work in close proximity to one another due to limited space available making social learning an almost inevitability. Because of the close working conditions, Bandura's work shows that through modeling, employees are able to apply this theory to work related needs in casual and passive learning environments with very good results while making the learning process more enjoyable for all involved (Deaton, 2015). What begun as face-to-face interaction stimulating learning through social interaction is now changing the landscape of new media where employees now learn from one another through social learning using social media as a venue. As technology continues to proliferate in society, so has the use of social media in the workplace.

Social Media in the Workplace

As a result of developments in technology in recent years, many organizations are using social media to collaborate, communicate and to share knowledge about work related issues. The use of social media as a communication platform has expanded the professional networks of its users and has eliminated many of the geographical barriers that once challenged global collaboration. Social media is convenient and is often instantaneous showing great benefits in those organizations that use it by offering improvement in teamwork and communication (Kiron et al, 2012). In organizations that use it, social media serves as a facilitation tool to encourage and enable interactions between employees of same and different organizations far beyond what is capable in a strictly face-to-face manner. Through social media, employees and organizations as a whole are able to access the "cognitive surplus" that society is available through these digital portals (Shirky, 2010). It is flexible enough to configure to an organization's needs while being cost effective. In addition, social media expands time and geographical boundaries as the Internet has brought organizations closer, making them capable of more effective collaboration and support for one another. Penick Brock, et al. (2014) explain "By capitalizing on social media and other resources that facilitate interconnectedness, faculty development programs and mentoring relationships can exist beyond the walls of traditional intra-institutional initiatives and contacts"(p. 2). Although there are concerns about misuse, workplaces can effectively put measures in place to help mitigate these risks. Social media can be a valuable tool in the workplace when used and controlled properly.

Social media is ubiquitous in society. "Over the past decade, there has been an unprecedented proliferation of social media" (Van Dijck, 2013, p. 8) In the United States, over 65% of adults use social media in their everyday life (Perrin, 2015). Globally, the user base has

grown to 1.26 billion daily users (Sedghi, 2014, p. 129), consisting of over 220 million daily Twitter users (Twitter, 2017, p. 2), and over 1 billion people worldwide using Facebook, LinkedIn, Instagram, Snapchat and YouTube in a typical 24-hour period. A definition of social media "is a group of Internet-based technologies that build on the ideological and technical foundations of Web 2.0" (Kaplan & Haenlein, 2010, p. 61) facilitating the almost boundless use of the collaborative nature of this type of technology. Social media tools allow efficient and effective two-way information exchange among individual or groups of users sharing images, text messages, email and video that can be consumed in real time or to be stored for later use, depending on the application and need for the material involved. This makes social media ideal for simple exchange of information between users, encouraging collaboration and communication.

Originally, social media was not intended for work-related activities but focused on the personal activities such as socializing, sharing of various forms of media, and connecting with friends (Mergel & Bretschneider, 2013). In a 2014 report by the National University in La Jolla CA, researcher Steven Brownson argues that,

> in the online environment, social learning media contain text, videos, audio, photo, and a combination of media. The idea of interactions evolved from cell phones and texting to web-based programs such as Twitter and Facebook, which promoted sharing photos, messages, and events that shaped one's life. Suddenly, hundreds of millions of young people were hooked on the levels of interactivity person-to-person and person-to-content, where they formed their vibrant social communities. The effect has been a totally wired generation who use the Internet

> and their smart phones in place of direct conversations as a natural form of communicating and discourse (p. 113).

Only a few years ago, the use of social media by anything other than individuals was nearly unheard of, yet over time its growing use by organizations has progressively expanded the online presence by embracing the tools found through Facebook, LinkedIn and Twitter, just to mention a few. Although "The Facebook" (The precursor to modern Facebook) was initially designed for use between students on university campuses, this social media platform soon would evolve to an application where anyone with Internet access could interact with one another. It would be just a matter of time before this and other online platforms would be used more aggressively by organizations to promote business related needs. Some other forms of social media have also experienced similar growth.

Over the past several years, social media has become a growing part of daily life throughout the world and many organizations have begun to incorporate these tools to address needs that are more business related. "Public, private, and nonprofit organizations have progressively increased their social media presence and usage to improve their relationships with customers and citizens, promote their corporate identity, and improve their communication" (Agnihotri, 2014, p. 1203).The use of social media in the workplace been gradually growing for a number of years and its use has been received well by organizations and employees alike. A recent survey by Microsoft shows that

> 46 percent of workers say that their productivity has greatly or somewhat increased because of social media use in the office, and more than one-third (37 percent) say that they could do their job better if their organization's management was more on-board in the use of social tools in the workplace. Microsoft surveyed

> almost ten thousand information workers across 32 countries and discovered that 34 percent of respondents believed that their management underestimates the benefit of social media in the workplace, even though two in five employees believe social tools encourage more collaboration and 31 percent say that they would be willing to spend their own money on a tool if it made them more efficient at their job (Forbes, 2016, p.2).

The power of social media in the workplace is through communication, collaboration and information exchange, all requiring input and response from multiple users (Leonardi, Huysman, & Steinfield, 2013). As a result of a higher number of users, the social media can provide abundant advantages between organizations and others as more individuals who use this platform leads to increased communication, coordination, and social capital building for all users (Khan et al,2014; Leonardi et al,2013). Simply stated, the more social media users utilizing a platform there are, the more capable the platform is to address needs of the users.

The content generated by social media includes a variety of new and emerging sources of online information that are created, initiated, circulated, and used by consumers with the intent of educating each other about products, brands, services and issues (Blackshaw & Nazzaro, 2006). Social media not only facilitates communication between and within organizations but also changes the ways in which a workplace operates.

> It is clear that interactive digital media platforms are changing the business landscape, and the nature and sources of information and connectivity are vast, in effect creating a 24/7 collaborative world. These platforms have empowered consumers to connect, share, and collaborate, creating spheres of influence that

have fundamentally altered the way organizations engage in influencing activities (Hanna, Rohm & Crittenden, 2011, p. 267).

Social media allows businesses to look at their organization from the outside in and make adjustments to their business model in response to feedback from users. "Social media technologies allow user-generated content and provide new opportunities and challenges for firms to transform their business. In particular, more and more firms have started strategically using the online user innovation communities (OUICs) for open innovation initiatives" (Dong & Wu, 2015, p. 113).

In addition to organizations benefitting from the use of social media in the workplace for non-learning needs, employees are also seeing personal benefits, as well. Research conducted at Grand Canyon University shows that

- 78% of workers who use social media platforms for work-related purposes say social media is useful for networking or finding new job opportunities.
- 71% of these workers say social media is useful for staying in touch with others in their field.
- 56% say it is useful for connecting with experts.
- 51% say it is useful for getting to know their co-workers on a personal basis.
- 46% say it is useful for finding information they need to do their job (Richard, 2016, p. 92).

Each day, new developments involving social media are published and the reach and flexibility of these tools can apply nearly everyone in the world. Although there are legitimate

concerns of the misuse of social media in the workplace, one cannot deny its benefit for the employee and the organization. In a heavily competitive global economy, social learning could give an organization the advantage it needs to perform at levels to make it successful for the long-term. Social learning can give employees the ability to use what they have learned so they can perform their job related functions better. Ultimately, the learning process in the workplace will likely yield measurable results. "Finally, in applying what we know in diverse ways, especially in authentic contexts, we are extending learning so that is has a purpose and can add value to our lives and the lives of others" (Yelland, Cope & Kalantzis, 2008, p. 203). In the workplace, measurable changes in the employee as a result of the training are an important goal.

Making the use of social media even more valuable is the ability to allow employees to acquire knowledge and support through a number of outlets at nearly any time of the day or night anywhere in the world where there is access to the Internet. Social media provides a means to address issues in real time when needed as opposed to waiting for normal business hours allowing the organization to be proactive versus reactive. Due to its low cost, the demand for social media use continues to rise. "There is an increased need for using social media to target specific HR activities, most importantly training and development" (Coursaris, Van Osch & Balogh, 2015, p. 2). Organizations are using the information gained through social media to make changes in their companies, involving both personnel and processes. These changes are having a direct impact on both the financial and non-financial performance of the organization. A 2015 study into the effects of social media on small & medium enterprises (SMEs) revealed that

> Facebook usage has a strong positive impact on financial performance of SMEs; similarly it was also found that Facebook usage positively impacts the non-

> financial performance of SMEs in terms of cost reduction on marketing and customer service, improved customer relations and improved information accessibility. Additionally, factors such as compatibility, cost effectiveness and interactivity were identified as factors that influence Facebook usage among SMEs (Ainin, Parveen, Moghavvemi, Jaafar & Mohd Shuib, 2015, p. 582).

More businesses see the value of social media to give an organization real time feedback. As social media continues to be developed, more users will likely use it to refine their business models. Organizations rely on accurate information to help guide their business decisions and studies on the effects of social media combined with the feedback acquired from this platform are excellent places for this guidance.

Researchers continues to evaluate the use of social media in organizations. Until recently, many organizations had no idea how social media use was affecting their workplaces, whether positively or negatively (Kavanaugh et al,2012; Khan, Swar, & Lee, 2014). Research shows that social media tools can help organizations address work related needs in a very efficient way but also reveals how there can also be privacy concerns, time wasting, and other challenges associated with its use (Oliveira & Welch, 2013). Studies involving the use of social media in the workplace continue to be completed; however, the studies that have been conducted so far yield conflicting results (Bertot, Jaeger, & Hansen, 2012). Some research reveals a very positive impact on the organizational performance while other research shows the opposite. This conflict can leave training managers confused as to if the use of mobile technology and social media will offer them the benefits they desire. “Educators and trainers today are wondering about the effectiveness of the use of mobile devices in teaching and learning without enough evidence of how much is gained beyond the ‘coolness factor’” (Anand, Chhajed, Hong & Scagnoli, 2014, p.

543). Many organizations fear the misuse of social media in their workplaces and as a result of the conflicting research that is available and potential risks associated with its use, many organizations may reject any positive value social media use may have and avoid its use and simply choose to avoid its use until more definitive results are available. This fear of not fully understanding risks of social media "shifted people's engagement with social networking sites or Skype and made them reluctant to engage with social media" (Witteborn, 2014, p. 77). Unfortunately, this hesitation may cause many organizations to never take the opportunity to understand the capabilities of social media for learning in their workplaces. Although the hesitation is substantiated regarding the risks of social media use in the workplace, measures can be implemented to mitigate these risks.

Risks associated with the use of social media in the workplace

As the number of people using social media grows and its daily use becomes increasingly frequent, organizations must establish common rules to avoid misuse, reduce privacy risks, and prevent security problems (Bonsón et al,2012; Mergel & Bretschneider, 2013). If these rules are not clearly presented to employees, confusion about social media's proper use will likely occur.

> Employees expect that social media will be made available for personal use during the workday. With the availability of the Internet to access social media, the lines of appropriate use and extraneous use can become blurred. Because of this, the use of social media is often criticized and the its potential as a knowledge-sharing tool may not fully be realized. This is an example of how the confusion becomes a manifestation of the complex division between personal and professional boundaries that employees conscientiously have to navigate within the workplace (Walden, 2016, p. 361).

This confusion has consequences and can lead to significant situations damaging organization. Some of the social media-related risks can include, "Employees involved in social media inadvertently leaking sensitive company information and damage to a brand or company reputation from negative, embarrassing or even incriminating employee or customer posts, even those that are well-intended" (Stenmark & Zaffar, 2014, p. 72). There are techniques that can be put into place to help reduce the risks associated with the use of social media in the workplace. To best protect the employee and organization, guidelines for social media use should be communicated clearly to all employees within the organization.

There are some considerations involving the use of technology and social media in the workplace that organizations should be aware of. In 2012, Brogan described some practical challenges to the use of social media that may occur in an organization. These include:

- Potential productivity and efficiency reductions
- Firewall, security, and bandwidth issues
- Intellectual property breaches
- Confidentiality concerns
- Policies must be authored to control the use of the technology and the intellectual property of an organization (p. 12).

The risk of lack of control of intellectual property is a major concern for some organizations and many workplaces have implemented firewalls and filters on emails to mitigate the risk of losing control of this valuable resource (Fontana, Milligan, Littlejohn & Margaryan, 2015). Data security concerns are usually high on an organization's list of concerns and although it may

appear to only involve data, the monetary value and market standing that an organization may hold can be directly linked to this form of asset (Fontana, Milligan, Littlejohn & Margaryan, 2015). Emails, Instant Messaging and even videophone conferencing have all been sources of security breaches when used inappropriately (Fontana, Milligan, Littlejohn & Margaryan, 2015) but the risks can be minimized or even eliminated with the proper safeguards put into place. In some cases, organizations will limit Internet access so significantly that its use becomes meaningless and unproductive. This undermines the usefulness of social media so for the use of social media to be useful and safe, organizations must find a middle ground that is acceptable if the use of social media is expected to fulfill the needs of the workplace.

To allow social learning through the use of social media to develop to the fullest level possible, Internet access must be made for the employees to use continuously. "Networked social technologies and internet access are ubiquitous. To have an effective learning system utilizing online resources, consistent and reliable access to the Internet is assumed" (Littlejohn, Falconer & McGill, 2014, p. 115). Using social media to satisfy workplace needs requires constant Internet access and extraneous use of it for other things outside of workplace can be a temptation, leading to disruptions in work related activities. Unfortunately, in organizations where abuse has been experienced, access to the Internet can be tightly controlled or eliminated in an attempt to eliminate risks associated with its use. Social learning through the use of social media can add to the overall effectiveness of a workplace and the required learning, but many organizations have reservations associated with its implementation and use (Dearborn, 2013). As technology and its use continue to grow in organizations, so does the potential for its abuse.

Even if there is not abuse or regulation of its use in a workplace, there can be other considerations that are a risk to organization through the use of social media. Internet access

bandwidth has also been an issue for many organizations as the use of the technology has grown very quickly in this country and throughout the world. The escalated level of Internet use within an organization can lead to limiting or even an absence of Web access at various times of the day causing delays or failure to complete work related needs. Bandwidth describes the maximum data transfer rate of a network or Internet connection. It measures how much data can be sent over a specific connection in a given amount of time. If users are consuming a significant amount of data, congestion of the data system occurs, slowing down or even stopping others from usage. Although bandwidth is not as much of a problem as it once was, it still has the potential to limit the abilities of the workplace to function properly (Dearborn, 2013). Many of the common social media sites pay for their services through advertising and as a result, many of these sites have a significant amount of advertising embedded within them. "The social media has huge amount of unnecessary advertisements on Facebook and YouTube which caused the more utilization of bandwidth and slow the browsing speed and throughput of network" (Hussain, Bhutto, Rai, Hussain & Zaheer, 2016, p. 34). In the book, "Smart Policies for Workplace Technologies" (2017), Attorney Lisa Guerin discusses how "Misuse of technology – whether in the form of streaming video, visiting illicit websites, or sending excessive personal email – costs time and money." She continues to say that "Your company can preserve bandwidth and server capacity, and maintain higher employee productivity by adopting policies that limit how employees may use technological resources" (p.12). With the proper safeguards in place, an organization can have confidence in the availability of Internet bandwidth when needed.

Because of the lack of historical examples to draw upon to offer guidance, there is a distinct absence of regulation regarding the use of social media in the workplace. In the long

term, policies and guidelines are needed to mitigate concerns about privacy and data misuse (Campbell et al, 2014; Kaplan & Haenlein, 2010). “The rise of social media such as Facebook and Twitter has provided employees with means to share work-related information. Increasingly, social media governance policies are beginning to be implemented to negotiate the risks and opportunities of such behaviors” (van den Berg, van den Berg, Verhoeven, &Verhoeven, 2017, p. 150). To better mitigate risks associated with technology use, employees should be made aware that activity in the social networking system can be monitored and misuse has consequences. Many organizations have guidelines procedures in place to inform employees of the risks associated with technology and the consequences associated with not following the prescribed protocol (García-Peñalvo, Colomo-Palacios & Lytras, 2012). In many cases, to mitigate the misuse or potential loss of information through the Instant Messaging (IM) system, many organizations limit IM use to internal communication only. Bingham & Connor (2015) discuss some solutions that may help limit the extraneous use of the Internet in workplaces:

> • Be specific. Make sure employees identify the blogs, wikis, and other sites they request access to, and provide a business case relative to the job.
>
> • Make sure you develop, or collaborate in the development of, an acceptable-use case based on sound business principles and risk management.
>
> • Inform the employees that the system administrator can track the sites employees visit. (p. 47)

In a 2017 study, it was demonstrated that the manner in which social media was being used in an organization depends how it was controlled and the measures that were put into place to govern its use. “In the prevention scheme, managers usually attempted to regain control by restricting

social media to private use only, while in the promotion focus managers trained and facilitated employees for work-related social media use, to various extents"(van den Berg, van den Berg, Verhoeven, & Verhoeven, 2017, p. 151). Perhaps it is because of this variability in use and the range of possible methods for the control of misuse that makes the mitigation of the risks so challenging. As the research shows, there is risk associated with the use of social media in the workplace but these can be managed and the risks reduced if expectations are communicated well. The benefits of its use can allow organization to communicate and collaborate in ways not possible before may mitigate against the risks. Social media also offers a venue to expand the channels through employees learn and are trained. In sum, when managed well, the risks of using social media might be outweighed by the benefits.

Social Media for Workplace Learning and Employee Development

As technology continues to change, so must the way organizations approach employee development. No longer will the "one size fits all" methods of employee training be adequate enough to meet the needs of the workplace. "The rules of traditional knowledge sharing, learning and training in organizations are changing due to globalized economy, technology advancement and shift in workforce demographics. It is an important time to examine these changes and understand how they have impacted the field of HRD" (Li, 2013, p. 247). These changes are being witnessed in a variety of organizations. Penick Brock, et al., 2014) explain how "This type of informal, social media based learning community is a reasonable and highly feasible option for faculty members seeking an alternative to or complement for traditional intra-institutional faculty development programs" (p. 4). Organizations are beginning to see how social media allows employee development to utilize the power of social media and the ability to cash in on the knowledge bank that is available through many users contributing to learning through social

media.

> The evolution of social media made all forms of employee development based on informal training by means of computers gain significance. Although part of the researchers calls them e-learning, it seems more justified to use the name "we-learning" which is also called social learning by some researchers" (Łuczak, 2015, p. 4).

Albert Bandura demonstrated through "learning that occurs through observing the behavior of others. This form of learning does not need reinforcement to occur, but instead, requires a model" (Bandura, 2003, p. 482). When Bandura was conducting his earliest research, the observation of others was done primarily face to face. However, over time it has been discovered that social learning can also take place at a distance. Many believe that there are few substitutes for face-to-face (FTF) learning. Some researchers believe that FTF activities and the social learning that is a part of it cannot be replaced by online activities because normal communication processes are disrupted by the lack of physical presence, making cognitive, meta-cognitive and social learning more difficult (Lee & Chan, 2007). Although there are many who contend that social learning cannot be accomplished adequately through the use of social media, there are many others who feel that the transfer of knowledge using this tool can be very effective. The validity of using social media to facilitate social learning can be seen when analyzing this phenomenon through the prism of the concept of social learning presented by Bandura, who stresses that the ability to learn through observation and exchange of views also allows learners to acquire specified behavioral patterns without the need to shape certain behaviors gradually, through learning by doing (Bandura, 2007, p. 29). Social learning should be understood not only as learning from others, but also as learning with others (Bingham & Conner

2010, p. 6). Social media offers a platform for this interconnectivity to take place without the restrictions of those involved to be in the same room at the same time. Thanks to the increased presence of portable technology, social media is more accessible than ever before and can be used to complement classroom learning. Although not a replacement for formal classroom learning, the use of social media for workplace learning is an excellent way to involve the learner in the learning process embedded within work processes themselves.

Supporters of online learning who are confident that learners have the ability to acquire knowledge socially though these media have argued that online communications can provide a more convenient and less intimidating environment for communication allowing for more successful social learning to take place (Zhan, Xu &Ye, 2011). Dabbagh & Kitsantas (2012) share that at the time of their research "students are using social media to foster informal learning communities surrounding the course topics thereby extending the Personal Learning Environment (PLE) from a personal learning space to a social learning space" (p. 6). Researchers Chen and Bryer continue to exemplify this point by stating

> In the new digital age, social learning is integrated with social media technologies. In the world of social media proliferation, learning is not an internal, individualistic activity. Rather, learners gather information from connecting to others' knowledge using Wikipedia, Twitter, RSS, and other similar platforms (p. 94).

Some social media theorists also argue that physical co-presence is not a necessary part for constructing psychosocial learning processes (Zhan, Z., & Mei, H., 2013). Social media is being found to be successful in knowledge transfer even without the face-to-face interaction, literally opening up the world to share understanding with one another.

Workplace learning has been and continues to be one of the most important yet challenging aspects of any organization and the introduction of social media has only made the choices for learning more confusing. Considering that many people are current users of social media, Qi & Chau (2016) express that the migration from personal use to workplace learning should be a fairly easy transition because

> if employees are already using social media tools at home and at work for their personal purposes, the organization can leverage this existing skill set to enable the employees to use collaborative media for knowledge management and workplace learning. However, it should be noted here that the organization must carefully develop, design, implement, and assess systems integrating collaborative media tools within the organization that will result in effective knowledge management and purposeful learning (p. 337).

Social learning has been used in workplaces for many years and now social media provides an ability to fulfill this need from a distance giving organizations a valuable tool to make their training and development programs more interactive and engaging. With the continuing and rapid expansion of social media in the workplace and in daily life, nearly all employees are at least moderately able to maneuver through most forms of social media. Because of this familiarity by most employees, it could be a logical step to investigate the use of this tool to help fulfill workplace training needs. A 2016 study by Qi & Chau showed the value of the use of social media for workplace learning and how it has taken the social learning theory to a new plateau by stating,

> It is predominantly unstructured, experiential, and noninstitutional that happens as employees carry out their daily work; it also encourages knowledge transfer and

> connects people in a way consistent with how they naturally interact through social learning. The learning activities with social media are the new generation of learning in the open organizations where social media is not only used as a tool for communication or marketing purposes but also a means to improve organizational learning (p. 333)

Portable technology, social media and cloud technology have aided in the transfer in knowledge and freeing learning from fixed space and geographical boundaries. This virtually boundless use has caused an increased need for applications that facilitate access to social media and the hardware that is being used to host the applications. As a result of increased need, many manufacturers have experienced an expansion of abundant and inexpensive technology and related services to help facilitate social learning though the use of social media in the workplace (Fontana, Milligan, Littlejohn & Margaryan, 2015). As a result, interest in social learning through social media is expanding at a remarkable rate. "There is a growing interest in how social media can contribute to increased situated and workplace learning" (Breunig & Breunig, 2016, p. 261). As Brownson shares in 2013, social media can be a powerful sharing tool encouraging collaboration about any chosen topic. Understanding this, the opportunities for social media for learning are significant.

Powered by countless applications, social media can provide an excellent venue for workplace learning. Many applications are being developed daily and each can offer benefits that the other avenues of learning cannot or will not provide. Social media offers a number of free applications but many also have a cost associated with them. The most popular (by user population) free social media sites available are Facebook, YouTube, Twitter, Instagram, and LinkedIn (eBiz, 2017, p. 1). Most of these sights would be more accurately described as a

"Freemium" online application. Freemium is defined as "a sales strategy, especially on the Internet, in which the basic product or service is free, but customers are charged for additional features and content" (Dictionary.com, 2018). In many cases, all of the previously mentioned social media sites can be utilized for free or with a premium, depending on the needs of the user. Other sites available that are similar to the free or freemium platforms but require a charge to use include App.net, GitHub, ZenZuu, Hash Bush, and others. Many users choose the paid social media sites due to the elimination of advertising and other risks that can be associated with their use. The risks of personal computer hacking, privacy and confidentiality issues and scams can also be a significant deterrent for their use, where often, the paid platforms address these concerns more completely as well as making these applications more flexible and aligned with the needs of the user and the organization. A study conducted in 2012 explains how these free tools can offer limitations by stating, "Furthermore, we have selected only commercially available tools, since free tools have the tendency to either offer limited support or non-customizable options" (Stavrakantonakis, et. al, 2012, p. 53) The choices and combinations are nearly endless and it appears that there is an application that can be easily configured for nearly any need. These applications will likely never eliminate the need for some workplace learning such as formal and regulatory learning to take place formally in a classroom.

There will always be a need for formal classroom training, but the landscape of organizational development is changing rapidly (Manuti, Pastore, Scardigno, Giancaspro & Morciano, 2015). Research indicates that a blended approach involving formal and informal learning techniques is currently desired, even in the midst of the explosion of technology in the workplace. Plebańska & Kula (2011) explain that it is not possible to entirely replace traditional training methods with the ones performed strictly in the virtual world. The researchers explain

that a combination of modern technology and traditional solutions may bring about very good results but for any employee development program to be fully effective, training departments must use the most appropriate method that allows the employee to have full engagement in the learning process (Manuti, Pastore, Scardigno, Giancaspro & Morciano, 2015). “Studies have overwhelmingly shown that blended learning has not only improved pedagogy, access and flexibility but also learner engagement and participation” (Maarop & Embi, 2016, p.41). Although social media for learning is showing potential to revitalize workplace learning, student engagement is paramount for the success of any training / employee development program.

Consideration of the learners involved in the training process must also be a key factor when developing learning programs (Overton, 2010). What may be appropriate for one group of employees may not be effective for another group. Organizations are now complementing formal classroom training through the use of social media. “Social media technologies that allow learners to connect to educational contexts in new and meaningful ways beyond the traditional learning environment have the potential to blur the line between formal and informal learning” (Chen & Bryer, 2012. p. 89). This gives the learning/employee development team the ability to customize their organization’s learning process to make it most effective. Plebańska & Kula (2011) show the importance of social learning through the use of social media when stating “such processes of employee development are learner-friendly, not only because it does not involve often unacceptable teacher-student relation, but also because of making the distance between the participants smaller” (p. 29). A 2016 study expresses that it is paramount to fully consider all aspects of a student when designing a learning program. Mary Polter expresses that it is “important to consider student commitment, background, aspirations, and aptitude” (p. 47) to help ensure the highest level of engagement in a learning process, making it as effective as

possible.

For the use of social media in workplace learning to be effective, the proper tool and platform must be selected for their ability to effectively and efficiently carry the learning method (Puijenbroek, Poell, Kroon & Timmerman, 2014). The criteria used to make this selection can vary from organization to organization and as experienced with many learning systems, an organization may find that employees react to one form of social media mush better than another. There is a certain level of trial and error that will take place and revisiting their effectiveness over time is expected to keep the learning program effective and relevant. In the most basic case, social media is serving as nothing more than a tool to allow employees to communicate with one another. Learning through social media should result in the desired learning and development of the employee similar to that achieved through face-to-face learning. However, unlike traditional classroom learning or self-paced tutors, this form of learning allows the employee to have some control over the development of the learning process allowing for the creation of a very personal learning experience.

The culture of learning in the workplace is shifting rapidly and often moving in directions that are foreign to long-term training managers (Overton, 2010). Current training programs must transition with these changes to be most effective with employees, especially the millennial generation (Weinstein, 2015). As the culture in the workplace transforms, so must the way training takes place. The use of social media tools to facilitate learning in organizations is growing (Kane, Majchrzak& Ives, 2010; Treem & Leonardi, 2012). As of 2012, four out of five companies are using social media in some form of their employee development program (Overby, 2012). Research in 2012 showed that 86% of managers believe that social media will be important to their business in 3 years (Kiron, Palmer, Phillips & Kruschwitz, 2012). Research

conducted in 2016 shows that an overwhelming 94% of American organizations use social media as part of their business plan either in marketing, employee development or a combination or both (Carlson, Zivnuska, Harris, Harris, & Carlson, 2016).

The content that is being consumed by the learners is dramatically changing both in its volume and sources (Bingham & Connor, 2015). Where video tutorials were once limited to VHS tapes, DVDs and classroom learning, now are available anywhere at any time through the use of social media. In addition, the amount of searchable references has grown significantly as social media allows the learner access to countless forms of learning material. For many years, information that was being used within the workplace was either generated internally by management or their designee or from a professional, commercial source. Now, this educational content is being created and consumed by employees engaged in the work related to that content area. Wilkens (2008) describes how

> this social aspect of content provides an avenue for additional social networking and mentoring opportunities, and further empowers the workforce by providing opportunities for them [the consumers] to contribute, resulting in significant increases in the volume of content. This has the dual benefit of helping with both retention and productivity, while also moving the organization toward a deeper, more ingrained use of learning and knowledge" (p. 6).

Mason and Renniet (2008) write that there were four major benefits of learner-generated content that social media for learning can provide:

- The learners have the tools to actively participate in the construction of their experience, rather than passively absorbing content.

- The content can be continually refreshed by the learners rather than requiring expert input.
- Many of the tools are collaborative in nature, thus the learners develop team skills.
- Shared community space and inter-group communications are a large part of what excites young people [and many people of other ages]; therefore it should help to motivate them to learn. (p. 28)

Research conducted in 2012 showed that "Participants successfully integrated social media, such as videos and case study materials, as part of their instruction in classes" (Chen & Bryer, 2012. p. 94) showing that the use of social media for learning is becoming more common in many environments. Social media is a new and powerful tool for all learning platforms. By its nature, it is typically portable and configurable to nearly any need. The ability to configure the learning experience for each organization makes the value of social media in the workplace high.

Each organization will have a unique blend of learning modes and methods that will allow the maximum benefit for the organization and the employee (Overton, 2010). "In a world of endemic divergence, the old, one-size-fits-all, on-the-same-page curriculum is no longer a good idea" (Kalantzis, 2006, p. 21). To help facilitate the broad needs that lead to more effective learning in the workplace, many changes to the traditional training / employee development model are being made. These changes can allow an effective learning environment to create learning processes that engage employees to work at high levels and to yield exceptional results. In addition, these changes signal to employees that their needs are valued by the organization. This can lead to deeper engagement in the learning process and their jobs. A 2015 study concluded that "student engagement in blended learning courses is a critical aspect of the

learning process and a combination of various learning strategies and technologies can help to motivate and engage students" (Zacharis, p. 51). By making the learning process truly personal, student engagement and knowledge retention will be higher, benefitting both the trainee and the organization.

> Through the affordance of a wide range of tools and equipment, digital technology has allowed learners to personalize their learning space, to gain extended access to learning opportunities, to enhance individual and group performance support through knowledge sharing in real time (Li & Herd, 2017, p. 185-186).

These changes in technology are creating a more personal learning experience for the learner and as a result, the employees are able to engage in the process and achieve improved learning outcomes.

Social learning through social media use is usually significantly less costly that traditional workplace learning models. Josh Catone explains why by sharing that "because the nature of information produced and consumed for learning through social media is such that it can be created once at a reasonably low cost and distributed and consumed over and over again for free, driving the overall costs of a modern employee development program down to much less than previous learning programs" (2018, p. 12). It can be performed with little to no impact on daily activities or production making it attractive to organizations that do not have a significant amount of capital to invest in the learning program. In addition, this form of learning is very flexible and can be made to work for nearly any sized organization. Because the use of social media for social learning can be inexpensive, it opens up its use to all organizations, even those that have small budgets for training and development. The availability of technology and

applications makes this learning model easily configurable to nearly any application making it reach employees in ways not possible before. In a 2013 study investigating the use of e-learning and social media systems, the authors conclude that, “These systems have become popular tools for facilitating teaching and learning processes that allow flexible learner-centered education” (Lee, Hsieh &Chen, p. 173). Social learning continues to evolve and with the introduction of social media, this form of learning can take place over any distance.

One of the most powerful and convenient reasons for the implementation of social media for training/employee development is the removal of requirement of the learner and the teacher to be in the same room or even on the same continent. Technology has made the world smaller and serves as a portal for worldwide communication offering the learner the convenience of a number of venues for the learning to be used regardless of location. The development of the Internet has aided in learner performance and the increased engagement of the learning process. “Many workplace communities have been developed as a result of the expansion of the Internet and there are a number of ways in which these groups can help support employee development, performance, and growth” (García-Peñalvo & Lytras, 2012, p. 754). For many years, employee development programs were limited to the local area and those who were present at that location. Now, though the use of social media, those boundaries hold less significance. Brock, et al. describe how “By capitalizing on social media and other resources that facilitate interconnectedness, faculty development programs and mentoring relationships can exist beyond the walls of traditional intra-institutional initiatives and contacts” (2014, p. 2). By breaking these barriers, it allows members of similar interest and/or profession to collaborate as a unified community in ways that were to available before the use of social media.

One area that has seen rapid growth is the use of social media in the form of workplace

communities. Workplace communities often provide an instrument for apprenticeship, connecting lesser-skilled workers with their more experienced colleagues through social networking technologies (Emke & Stickler, 2011). This kind of learning through technology may involve an "Ask an Expert" feature added to a Learning Management System (LMS), so drawing from the expertise of individuals from all over the world much more accessible (Kelly, 2014). David Wilkens expresses the importance of how this provides an avenue for additional social networking and mentoring opportunities, and further empowers the workforce by providing opportunities for all of the users to contribute, resulting in significant increases in the volume of expertise. "This has the dual benefit of helping with both retention and productivity, while also moving the organization toward a deeper, more ingrained use of learning and knowledge." (2008, p. 6). This kind of learning relies on the collaboration of workers in and out of an organization to address needs that may not be able to be addressed otherwise and workplace communities can offer timely and effective expertise for the learner. One form of a workplace community has been theorized as the Community of Practice (CoP).

Communities of Practice have been in existence for many years. The concept was first proposed by cognitive anthropologist Jean Lave and educational theorist Etienne Wenger in their 1991 book Situated Learning (Lave & Wenger, 1991). Wenger later refined the term to more closely align to what is commonly found today (Wenger, 1998). Professionals from specific areas would get together to share experiences between the members in hopes of making a stronger and more informed group overall. In some professions, these Communities of Practice have been used to maintain competency in their field of expertise. Every 2 years, flight Instructors are required to have 16 hours of interaction through these communities to maintain their instructor credentials. Other professions such as attorneys, medical doctors and others have

similar requirements to ensure that the people in their ranks are current and relevant. Although many have heard of the term, a Community of Practice can be defined in a number of ways. Chikh, Berkani & Sarirete define it as

> a community whose main goal is learning. CoP is a concept showing that learning means participate in order to gain expertise (learning by doing). CoP can be considered as a means by which knowledge is owned in practice. It is about a group of professionals who gather and organize themselves, face to face or virtually, in order to: i) share information and experience, related to their field of intervention, ii) exchange and cooperate in order to solve together the problems with which they are confronted in their occupations, iii) learn from each other and thus develop their professional competencies, iv) build (improve and/or create) together knowledge and to formalize the best practices to be followed in the realization of their daily activities. These individuals share a common interest and are led by a desire and a need to share a concern, a whole set of problems, or a passion on a subject (2008, p. 32).

This kind of knowledge sharing would only be complemented through the use of the Internet and social media in later years.

Collaborative learning through social media is being enhanced through the use of CoP (Sand & Chakraborty, 2015). As these communities are being created by employees who have a shared concern, problem or passion about a certain subject or topic, CoPs allow the members to share information and expertise freely allowing timely learning without boundaries. The abundant availability of Web 2.0 social media allows individuals to form these groups easily and freely, allowing open interaction for effective and efficient exchanges of knowledge and

experiences (Thomas & Akdere, 2013). Although these CoPs are still relatively new, the results of their use are already showing favorable results in many areas of business (Sand & Chakraborty, 2015). Like many others forms of social learning, these are likely to see continued growth in the workplace, generating more usable content to be shared by many employees in workplaces throughout the world.

The use of social media may be able to provide a low cost option for training while empowering employees to perform their jobs at levels never reached before while being able to maintain a competitive advantage in an ever-growing global economy. Social media may be able to act as a portal to facilitate training through social means. Making the choice for social learning through this platform becomes more challenging due to the lack of research that is available showing the benefits or limitations associated with the use of social media for workplace learning. Only a small number of studies currently exist on the subject and the results still give conflicting results (Bertot, Jaeger, & Hansen, 2012). Through additional research, organizations can become better educated to decide whether they want use social media for their workplace learning to empower their employees to perform at levels that will please their customers.

Twitter for Workplace Learning

Twitter, located on the Internet at www.twitter.com, was developed in March 2006 by founder Jack Dorsey and contractor Florian Weber for use within the podcasting organization, Odeo. It was envisioned to be a tool where members of the organization could communicate quickly and concisely through an SMS-based communication platform. At that time, Dorsey was a student at New York University and assigned a code name for it, twttr. The primary purpose of the twttr messaging system was to allow an outlet for “short bursts of inconsequential

information" (twitter.com) and allow the users to interact much like having a conversation. Dorsey had envisioned how this communication platform would allow user to quickly communicate with one another with short, concise messages called Tweets. After Dorsey had relinquished the rights to the communication platform to Odeo, he quickly realized that his team had created something truly unique and bought back the twttr platform from Odeo. From that day forward, the San Francisco based Twitter has continued to see growth and profitability while providing a far reaching platform for users to communicate quickly with one another throughout the world. Twitter has seen consistent expansion of its use over the years to reach a reported level of 319 million active users in 2016 and over 500 million tweets per day. A single year later in 2017, that number grew to 420 users sending 1.3 billion tweets per day. Of those users, 82% are mobile users and 79% are outside of the United States (Twitter, 2018). 2016 also saw the introduction of the capability of streaming video as part of its functionality enhancing the Twitter user experience. This enhanced user experience has helped to drive Twitter to become a large, International communications platform recognized throughout the globe. Over the years, Twitter has been used by nearly everyone with access to it. In December of 2012, Pope Benedict XVI created his new Twitter account as @Pontifex, becoming the first pontiff to lean on social media for communication. Since that time, his successor, Pope Francis, has maintained the papal account, which now has almost 3 million followers for the English language account, and 3.7 for the Spanish Twitter handle, @Pontifex_es. United States Presidents are also not absent using Twitter for communication. Barack Obama and Donald Trump are well known users of Twitter and some controversy has arisen from its use in an official Presidential capacity. As shown, Twitter is being used by many throughout the world and is being used in ways that even Dorsey likely had not envisioned. Although not originally designed for use as a tool to support

education, recent years and uses show that this social media platform offers a valuable asset for learning in and out of the classroom.

For nearly two decades, educators have attempted to take advantage of students' attraction to the use of digital and web-based technology by integrating it into their learning process. One of the more recent web digital tools that have been introduced in the classroom is Twitter. Although many parents and educators have reservation in allowing the use of social media in the classroom and even in the students' lives, used correctly, the use of Twitter as a learning tool in the classroom can have the capability to help better engage and stimulate students (Downes & Bishop, 2012; Hur & Oh, 2012); to help increase academic results (Eden, Shamir, & Fershtman, 2011; Lazakidou & Retalis, 2010); and to improve attendance and discipline (Solomon & Schrum, 2007). Over time, even the use of the Internet has changed how students interact with it and one another. With the rapid expansion of Web 2.0 technologies and the applications it supports, students' use of the web has gradually changed from an experience where only consumption of material available on the web took place to a remarkable situation where students can create, share, and collaborate in ways that are not only familiar to them but more freely and candidly (Crook, 2008; Schuck, Aubusson, & Kearney, 2010). As educators are experiencing, Twitter can be powerful platform to help increase learning for students of all ages while having the ability to collaborate with fellow learners. Becker and Bishop explain that

> Twitter offers students meaningful connections to science, shared by reputable sources, as they develop and are shared around the world. Because these connections can be personalized, based on whom a student decides to follow, Twitter encourages students to realize connections between science and their own lives and interests. Beyond content consumption, Twitter also enables students to

> interact and share perspectives with others outside of their specific class. While these are often classmates, depending on his or her followers, a student's audience could extend far beyond his or her peers (2016, p. 6).

A recent article on the nprEd website discusses how many teachers are using Twitter to help excite and engage learners of all ages. In Kansas, a third grade science teacher hoped to show the students of his class how powerful Twitter can be used for spreading information between users quickly and broadly. The teacher said he "expected 1,000 or so retweets, but within days the tweet went viral and gained more than 227,000 retweets and 75,000 replies from users all over the world" (Figueroa, 2018). This example shows how powerful and pervasive social media and Twitter in particular can be and used correctly, can be a host for quick and expansive information exchange. As Soto, Hargis & Appelgate (2017) discuss, the use of Twitter for classroom use can offer a profound springboard for students to more fully engage in the learning process. "Students became excited, and their conversations quickly turned to roles, logistics, and ideas of what they might see. Each group left the room with ideas, and students began frantically capturing the experience on their devices" (p. 201).

As shown, the use of Twitter can have profound effects on school-aged student but can it also impact the older learner in a similar way? Adult learners have vastly different motives for learning and have had many different experiences than their younger learning counterparts that may contribute to a different outcome with Twitter's use for learning. Perhaps the use of this social media platform for adult learning will not yield the same learner engagement or outcomes as seen in the school aged examples. Kerry Davis explained how this was not entirely the experience observed in their research with the use of Twitter to help facilitate learning amongst teachers.

> Regardless of age or years teaching, subject area, or age, educators perceived Twitter as providing an online forum to reflect upon practice, exchange knowledge and experience, and be in the presence of supportive colleagues. While participants experienced the pace and volume of information as being overwhelming at times, educators developed skills to managing this and perceived discussions to be learner-centered and supportive. Teachers valued the sense of community and learning that they reported were not otherwise available in their own physical workplace. Overall, participants perceived that the benefits of participation in online Twitter chats for learning outweighed any drawbacks experienced (2015, p. 1551).

This example shows that while there are considerations to be aware of when proposing the use of Twitter for adult learning, many of the obstacles and concerns that may be experienced through its use are outweighed by the benefits. As with any form of social media use in the classroom the risks of using Twitter are similar making the learning platform a distraction to the students, allowing a medium for cyber bullying and discouraging face-to face communication, amongst others. Soto, Hargis & Appelgate (2017) explain that the

> use of social media can invite issues and abuses, so we advise caution in using it. Strategies to minimize potential negative interactions through Twitter include registering for a class account instead of individual accounts, using a hashtag, using privacy settings, and blocking other users (p.202).

As with any activity a student may partake in one the Internet, students need to be aware of how to maintain a level of privacy when using social media for learning as well as

learn how to disseminate copious amounts of information that is found online. As Scott Zimmer explains

> Apart from communication among professional educators, social media also represents another topic for instructors to teach students about. Because part of educating students includes helping them to develop the critical thinking skills necessary to evaluate media rather than blindly consume it, many educators are making social media the focus of at least part of their coursework. Just as students must be able to listen to news reports and read newspapers and magazines to be able to extract, evaluate, and synthesize information, they must be shown how to use that same lens of critical inquiry when they use Twitter, Facebook, and other social networking sites (2015, p. 1).

These cautionary considerations will help the educators maintain a certain level of control of the students using Twitter for learning while providing a safe and unique platform to help spark engagement and enthusiasm for the learner.

In many cases, once Twitter has been implemented into the curriculum, many students who use the social media platform will have a positive experience through its use for learning. Research by Lowe and Laffey in 2011

> assessed the impact of using Twitter in a university marketing course by administering a 5-point Likert scale survey and conducting interviews after 8 weeks of usage. They asked questions about the perceived usefulness, enjoyment and effectiveness of Twitter. They found that take up of Twitter was good with more than 65% of their course voluntarily following the course's tweets. Using

> one-sample student's t-tests, they found that of the 46 anticipated learning outcomes surveyed, 80% were statistically different from neutrality indicating overall positive attitudes to the use of Twitter. Post hoc classification revealed that Twitter had provided enhanced learning about the subject, greater enjoyment of the module, concise and useful communication, timeliness, greater realism, greater application of theory to real-world examples, and valuable career skills in the use of new technology (p. 904).

The research shows that the proper use of Twitter for adult learning can allow this social media platform to help engage learners and offer them a portal for learning in a way that simply has not been available until recent years.

Twitter offers powerful, new opportunities for learners of all ages to share, interact, and explore. These activities are the hallmarks of Web 2.0 technologies. And because the dynamic nature of Twitter not only leverages the learners' innate social nature, this social media platform also provides those who are in charge of ensuring learning takes place with a powerful, multi-dimensional, multi-modal pedagogical tool whose benefits can be appreciated in real time. Moreover, each student's experience is inherently personalized and is influenced by the contributions of others throughout their peer group and throughout the world. As a result, Twitter fundamentally challenges traditional paradigms of teacher, learner, and classroom in exciting and profound ways. In a time when knowledge is so plentiful, with immediate communication, and having literacy into the Web and the use of the applications there, Twitter offers educators at all levels unique opportunities to explore and practice authentic use and collaboration through an open social networking tool for learning. Hennessy, Kirkpatrick, Smith and Border explain that

> there is no doubt that social media including Twitter plays an integral role in how students learn in current society; however, educators have yet to fully discover its potential as an educational adjunct and understand how it can be best incorporated into education practice (p. 514).

Whether the student is young or old, Twitter offers a firm foundation from which learning can be fostered and the correct use for workplace learning can be enhanced through the use of Twitter as a catalyst.

Relationship between Workplace Learning and Organizational Performance

A number of studies identify possible relationships between workplace learning and employee performance. In a growing and competitive global market, most organizations desire to use every advantage available to remain competitive. "Increasing competition has significantly heightened economic, technological, and transactional interconnections between global rivals" (Luo, 2007, p. 132). Employers who desire world-class performance from their employees usually have a very robust employee development program. Current literature shows the use of a wide range of examples that establish the particular effects on performance of training programs (Jacobs, Jones & Neil. 1992; Phillips 1996). Organizations are not the only beneficiaries of a workplace training program. Employees also are given valuable tools to equip them for the current job requirements and to use as a foundation for future workplace development. The benefits help employees on a personal level as well as the overall performance of the organization where they are employed. A 2014 study shows how "Employees' participation in informal learning activities benefits their workplace performance, and ultimately their long-term career development" (Bednall, Sanders & Runhaar, p.47).

Research published by Harrold (2000) demonstrated how productivity increased by 4.7 per cent at Honeywell and contributed $2 billion in measured savings based on the organization's investment in employee training/development programs. Concluding from a 2014 research project conducted in Bosnia and Herzegovina, Bayraktaroglu and Cickusic (2014) explain that

> that there is a positive correlation between the training and employees performance (Pearson Correlation .782) which means that 78 % training affects employees performances and 22% goes on other factors. It is a high correlation which explains us that employees really believe in training programs and that training programs are best for their performances (p. 2129)

In research completed in 2015, Delgado Ferraz and Gallardo-Vazquez share that, "All of these training practices can increase organizations' performance" (p. 663).

In most settings, employees learn constantly as a natural part of completing their job duties. This indicates that some workplace learning is a part of the social and informal aspect of completing the requirements of the job and that not all training/employee development is driven through formal means. When considering formal training, employee development "refers to an integrated set of planned programs, provided over a period of time, to help assure that all individuals have the competence necessary to perform to their fullest potential in support of the organization's goals" (Jacobs & Washington, 2003). However, to adequately measure the effectiveness of employee development, we must consider all aspects of performance. The examination of the competency of the employee can serve as a measureable indicator of how successful the employee development program truly is.

One approach to quantify the relationship between training/employee development and performance is to examine the employee's ability to perform job related functions. Recent research conducted by Shu-Rung & Chun-Chieh (2017) shows positive correlations between the used of training/employee development programs and job performance of those employees. The results of their findings reveal that employees are much more likely to perform and higher levels and with less error than those who are not afforded some form of training. When compared to those employees, fully trained employees delivered 27.9% more products and services while reducing errors by 53.33%. These findings similar to those found by Ekot (2010) who hypothesized "that the quality of an organization's training affects its value; he adds that untrained or poorly trained employees cost significantly more to support than well-trained employees do". Organizations that that develop effective training programs also experience higher production rates, improved attendance and superior employee morale while achieving increased profitability (McCleskey, 2014). Zakaria, Yasoa, Ghazali, Ibrahim & Ismail explain that

> In human resource context, employee development has proven to be significant contribution to organizational performance and this research has empirically verified the effects of formal training, informal coaching and employee empowerment on organizational performance. The findings revealed that employee development practices played a critical role in improving organizational performance (2017).

In addition to employee competence, many organizations use organizational financial performance as a measurement of success in the learning and development program.

A study conducted by McDonald and Smith (1995) involved the examination of 437

publicly traded companies to establish the connection between training/employee development programs and organizational performance. This research revealed that organizations that had no or ineffective training/employee development program were much less likely to perform well than those organizations that had a robust and fully developed program. The research showed that those organizations with developed programs performed financially better by 19.7% on average that those with poorly developed programs (p. 62). Research conducted in 2013 showed that the "training policy was positively related to financial performance and perceived financial performance within organizations" (Saks & Burke-Smalley, p. 106). Because financial performance is the ultimate goal of many organizations, they can at times be fearful that the resources out into a training program may not yield the results to justify the expenditure.

An organization can have preconceived ideas about the return on investment (ROI) with the development of training/employee development programs. The inability to forecast the return on training can cause an organization to ignore some methods of training. "Though managers have positive attitudes toward this kind of training and appreciate the related benefits, its future of is uncertain because only 10% of the managers participating in this study could guarantee an amount for their training budgets in the near future" (Lee & Singh, 2016, p. 72). Fear of a negative ROI by an organization can lead to a reluctance to implement an effective training/employee development program leading to poor work performance and elevated levels of attrition (Barnett & Davis, 2008). Although on the surface, refusal to implement a training/employee development program may appear to be a cost savings measure, research shows that the ROI for these programs delivers a very positive value (Pynes, 2004). The research studies above confirm that training correlates to the effectiveness and profitability of an organization.

An important goal of most organizations is ensuring customer satisfaction. Performance metrics are becoming increasingly important in the workplace and an organization that does not respond to the needs of the customer will often find themselves with no customers to be concerned with. Competition between similar organizations is fierce and customers are demanding reduction in overall costs. Many organizations are finding a distinct edge in their performance and customer satisfaction through the use of a number of quality and delivery performance methodologies. A 2013 study by Kafetzopoulos & Gotzamani into the effect of quality on customer satisfaction showed that "The ISO 9000 series of quality management standards provides the framework for organizations to install a QMS following certain guidelines and leads to continually improved processes that satisfy customers' requirements" (p.2).Through the proper implementation these tools, organizations are able to remain competitive in the global economy, competing with organizations throughout the world in an ever-shrinking planet. Most organizations realize that to be more competitive, a focus on training is needed to empower the employees to achieve the needs of the organization and the customer. One area of importance that training often focuses on is quality assurance and quality control.

Relationship between Quality and Delivery and Organizational Performance

As demonstrated in the last section, training/employee development can have a significant impact of the performance of an organization. However, a great deal of that training will likely involve the ability of the organization to produce the correct good or service at the right time. A 2016 study of apparel manufacturing showed that

> employee involvement in the training program has significant impact on improving cost effectiveness, product quality, on-time delivery and volume flexibility. Further, all training practices also show positive relationship with the

above manufacturing performance indicators (Wickramasinghe & Perera, p. 724).

Because we now live in a global economy, there is intense worldwide competition and ever-changing customer demands and these changes are driving organizations to alter the way they do business. As a result, companies can no longer rely on their current business operations (Zakuan, Yusof, and Shaharoun, 2009). To remain competitive in this global economy, organizations must adopt and implement new operation management systems that have shown proven results over time (Lien, B. Y., Hung, R. Y., & McLean, G. N., 2007; Lo, Sadikoglu and Zehir 2010; Zakuan, Yusof, and Shaharoun 2010). One of the most proven and sought after modern operation management practices is quality management. In the 2013 book, *Service Quality Management in Hospitality, Tourism, and Leisure*, authors Mok, Sparks & Kadampully share how "The holistic and interdisciplinary approach to quality has become imperative for hospitality, tourism, and leisure (HTL) service managers in their efforts to design and deliver superior quality of service" (p. xvii). Modern quality management originated in Japan during the 1950s andover the next several decades, this system would become increasingly popular in the United States and Europe. Currently, quality management systems can be found in many organizations, and the larger the organization, the more likely such systems are to be found (Stashevsky & Elizur 2000).Previous research indicates that the use of some elements of quality management without a complete quality management system in place can improve organizational performance (Naor et al,2008; Samson and Terziovski, 1999), while recent studies show that using techniques alone without a developed quality management system contribute to organizational performance improvement at a rate far less than those with an fully developed system(Gambi, Boer, Gerolamo, Jørgensen, F., & Carpinetti, 2015).

A 2005 study by Kannan & Tanexamined the extent to which Just in Time (JIT), supply

chain management (SCM), and total quality management (TQM) are correlated, and how they impact business performance. The research involved 556 organizations ranging from 10 to 200,000 employees. Much like the results of Gambi, Boer, Gerolamo, Jørgensen & Carpinetti, their results showed those organizations with a strong commitment to quality management experienced the highest levels of success in terms of organizational performance. The study further showed that there are relationships between a mature quality management system and the increases in performance in organizations. These successes may be caused by an increased ability to provide parts or services more rapidly as a result of increased operational synergy in their workplaces. Kannan & Tan (2005) state that

> by explicitly and effectively integrating JIT, SCM, and TQM practices into operations strategy, the potential exists to add value and to better position oneself to respond to competitive pressures. At an operational level, these quality managements system practices can be deployed together to create value. Whether it is by coordination and integration of activities throughout the supply chain or by recognizing the capabilities of immediate suppliers, understanding supply chain dynamics has a significant impact on performance. As the trend towards outsourcing and focusing on core competencies increases, organizations will be under greater pressure to effectively leverage supplier and customer relationships. The results demonstrate that doing so be a significant driver of a firm's success (p. 155).

The results of this research show the importance to have a complete and functional quality management system in an organization to ensure the ability to remain competitive in this highly competitive economy.

Since organizational performance can be strongly influenced by the quality management system (Alony & Jones, 2008; Hines & Jones, 1996; Womack et al,2007), a better understanding of the relationship between quality, cost, and delivery and organizational financial performance is critical. Hendricks and Singhal (2000) researched the ways in which financial performance in terms of stock performance, operating income and sales compared to the effectiveness of the organization's quality management system. Their research used stock price performance as a sign of organizational performance and profitability. The results from these studies showed that those organizations that had a robust quality management system in place experienced a 5 year stock price gain of 76% over those organizations that had no, undeveloped or poorly performing quality management systems. In addition to stock performance, the implementation and use of quality management systems in an organization can affect the working relationships between customer and supplier. For example, studies show that those organizations that engage in an effective quality management system can improve the relationships with both customer and suppliers (Black and Porter, 1995; Flynn, 1995; Kaynak, 2003; Kannan & Tan, 2005). This can lead to more abundant business opportunities leading to a larger market share for their organization.

Research also shows a direct link between the presence of a robust and mature quality system and an organization's financial performance. Many organizations either have a quality system in place or desire to implement one as the value of these systems can empower employees and the organization to be able to perform at levels that can maintain a competitive edge in the global marketplace. As Goetsch and Davis discuss in their 2014 book, *Quality Management for Organizational Excellence*, trends affecting the future of quality management in the 21st century include "increasing global competition, increasing customer expectations,

opposing economic pressures and new approaches to management" (p. 24). The researchers continue to discuss how an organization can more successfully compete in the global marketplace by having total commitment in the quality process, being market driven and having a commitment to leading people. By empowering people to be developed to a level that can bring excellence and quality to the organizational processes, workplaces position themselves to be more competitive in the ever-growing global economy.

Conclusion

Over time, social learning through the use of social media has begun to take a foothold in employee development in the workplace. An extension of the theory that Bandura described some years ago, social media is being found in many areas of today's organizations. Though the scope of results remains tentative, the research suggests that the use of social media for workplace learning can have a significant effect on the learner and the organization. As a result of the rapid growth in the various platforms and tools that are associated with social media have in domestic life, there has been transfer of the associated skills, practices and platforms into workplaces. Portable technology has speeded up this process, infiltrating nearly every aspect of life, becoming more affordable and powerful while also becoming easier to use. Although social media had been predominately used for personal use in its initial years in the early 2000s, an emerging and growing trend is the use of social media for learning in the workplace.

In addition to social media making an impact on the performance of a workplace, one cannot ignore the impact of training in the same way. As research clearly shows, those organizations that embrace a learning/employee development program see better profitability and market share than those that do not. Although the form or composition of training that contributes to an increase in performance is challenging to completely identify and quantify,

nonetheless, the combination of formal and informal learning clearly contributes to the financial health of an organization. To further enhance workplace performance, the implementation and use of quality management systems also shows a positive correlation to higher organizational performance. Quality management systems help to reduce waste in the workplace while increasing throughput and synergy making the organization operate more efficiently. In a very competitive global economy, these factors can likely be the difference between a successful organization and one that will fail.

The benefits of social media in the workplace, training/employee development and/or quality management systems far outweigh the concerns of using social media in the workplace. Currently, there appears to be a paucity of research results pertaining to the use of social media for learning that affects quality and delivery performance of a manufacturing organization. Those metrics ultimately affect the financial performance of the organization. To remain competitive in the challenging global economy, having a robust and developed training program that supports a mature quality system can give an organization a measureable advantage to be successful and to serve their customers in a very successful manner. The research undertaken for this dissertation into the relationship on how the use of social media for learning in the workplace affects quality and delivery performance of an manufacturing organization may prove to be a valuable tool for any organization to allow an them to perform at levels to keep them viable and possibly to thrive in a highly competitive global economy.

Chapter Summary

In this chapter, I have reviewed literature around four main topics in an attempt to build a foundation and explore connections between the four topics. First, I considered the social learning theory and how it applies to learning through the use of social media. The research

offers a baseline of understanding and how this theory is important to workplace learning. If more organizations are using social media in their workplace, especially for workplace learning, it would be an important step to understand how this learning theory can be applied in practice. A focus was placed on how the social learning theory might be applied in the workplace, in order to help identify the benefits and results that would be expected through the use of this application.

Next, I provided how the use of social media has affected the workplace. This is a particularly important section as this understanding frames a great deal of the research to be done in this study. Although a wide range of positive effects arising from the use in the workplace were discussed, a subsection also identified on the risks associated with the use and how to mitigate the risks of social media. Another subsection discussed how social media can be used for learning and workplace development. This is the largest of the sections and most closely aligns with the research to be conducted in this study. It was written to help better understand how social media used in the workplace can affect an organization overall, and also to investigate in depth how it would affect workplace learning. The following section examined the use of YouTube in the workplace to address a range of organizational needs.

Because of the lack of direct research is available about how social media for workplace learning and the effect on quality and delivery performance metrics in a manufacturing setting, the next section connects the ways in which workplace learning is related to organizational performance. This section helps connect the two ideas of workplace learning and organizational performance. There is no research that directly connects social media for workplace learning to its effects on quality and delivery performance metrics. For this reason, the following section discusses how quality and delivery performance will affect the performance of the organization.

Because of the lack of research in this area, it provides an excellent opportunity and justification for a study to be conducted in this area.

In these ways, in this chapter I have attempted to draw together many of the issues discussed above (i.e. social learning theory, social media use on the workplace, the relationship between workplace learning and organizational performance and the relationship between quality and delivery and organizational performance) in order to bridge a significant gap in research. I have aimed to illuminate the ways in which social learning theory is still a valid part of learning using social media and how the use of social learning through the use of social media can affect workplace performance. The entire synthesis of this literature review has attempted to offer a foundation to those in the manufacturing community who are considering the use of social media for workplace learning and the potential affects it may have on quality and delivery metrics. This important topic can help offer guidance to manufacturing (and other workplaces) to the value (or lack thereof) of social media for learning. In the next chapter I articulate my research design and methodology.

CHAPTER 3

METHODOLOGY

Introduction

This chapter opens with the Review of Related/Selected Literature and/or Research Methods. This section is followed by a description of the overall research design: a True Experimental, Pretest Posttest Control research model which employs only a quantitative approach. The presentation of the Pilot Study is offered at this point. The results of the Pilot Study are discussed leading into a conclusions section, an analysis of the strengths and weaknesses of the original research design and lessons going forward. The Research Design for the main study was modified as a result of results from the Pilot Study and involved the research questions and the research design. The research design section describes the appropriateness of the design, the revised research questions are a result of the Pilot Study, target population and research sample, the resulting sample, data collection, an overview of quantitative data, data analysis, incentives, ethical considerations, internal and external validity and the use of triangulation in this study. This section ends with a summary of all that was discussed in this chapter.

The purpose of this study was to examine the relationships between the implementation and use of social learning through the use of social media in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. Significant gaps in current available research leave a great deal of the relationship misunderstood. This research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can aid many organizations in the decision to use social media in their organizations.

Review of Related/Selected Literature and/or Research Methods

Relevant research regarding social media, workplace learning, social media in the workplace, effects of training on workplace performance and effects of quality management systems on workplace performance was initially identified searching University of Illinois database for previously published dissertations (IDEALS), the University of Illinois Library and Google Scholar for primary research material. A total of 29 research databases were searched for publications from 1975 through to the present (2017), with key articles obtained primarily from Educational Resources Information Center (ERIC), Resources in Education (RIE), Current Index to Journal in Education (CIJE), Dissertation Abstracts International (DAI), Wiley Online, Springer Database, EBSCO, Scopus, and the UIUC Online Collection. The search was exhaustive and the combination use of the Illinois Library and Google Scholar helped to refine the search and kept the total publications to a manageable level.

In order to ensure that relevant studies were not missed, the search terms remained broad. These terms included “social media”, “effects quality management system”, “effects employee development performance”, “social media training”, “social media learning”, plus any of the following: "workplace", “place of work”, “jobsite”, “Twitter for learning”, “Twitter in workplace”, “Twitter for employee development”, “Twitter Statistics” anywhere in the title, abstract or body of the work. No language restrictions were employed. Studies were eligible for consideration in this review if: (a) the information contained in publication considered social media (all types), workplace learning, social media in the workplace, effects of training on workplace performance or effects of quality management systems on workplace performance; and (b) any publication that focused on the workplace was given priority. Finally, a comprehensive search was made of Internet resources in the United States and Internationally. A

number of sites were searched, although the databases available through the University of Illinois library produced the majority of the publications used.

Pilot Study

Research Design (Pilot Study)

The research was conducted as a controlled quantitative research study where data was collected before and after the intervention. In this Pilot Study, the same sample of employees was used for the pre-intervention and the post-intervention. The intervention is the introduction of social media into the learning employee/development program. Social media introduced as part of the learning employee/development were as follows:

- The use of Twitter for problem solving was allowed and encouraged
- The use of texting between employees and outside of the organization for problem solving was allowed and encouraged
- The use of smartphones to use Google and other search engines for problem solving was allowed and encouraged
- The use of YouTube for problem solving was allowed and encouraged
- A group Facebook page was created to allow interaction, collaboration and communication was allowed and encouraged.

The study lasted for 3 months, with the previous 2 years of data being used for the pre-intervention baseline, followed by 3 months of social media for learning employee/development serving as the intervention. Data was collected post-intervention in the same manner as pre-intervention (automatically). This data is collected from two separate systems without human

intervention and cannot be manipulated in the raw form. Although the data can be manipulated once gathered, it was left in its unadulterated raw form for analysis.

Pilot Study Target Population and Research Sample

The Pilot Study was conducted in a metallurgical laboratory setting within Organization X. This laboratory has 64 total employees that comprised the population. A sample size of 50 was originally chosen but only 38 employees initially agreed to participate in the research study with their consent (verbal) with the understanding that this was an initial study. The 38 employees were assigned a number from 1-38 and using a random number generator, the group was divided evenly into two groups (Experimental and Control) of 19. Through the use of the random number generator, every other number was assigned to the experimental or control group. All of the participants had the option to choose to be a part of the Early Research Preliminary Study and could decline participation at any time. After the research had begun, 4 members of the Experimental Group could not participate to the conclusion of the study. 2 participants were laid off, 1was moved to another business unit and 1 left the research study half way through the study. The remaining 15 participants of the Experimental Group continued for the duration of the study. The Control Group was left at 19 since the study had begun and the researcher wanted to minimize disruption to the study. All factors listed in the Internal and External Validity section were used in the Early Research Preliminary Study.

To ensure that the treatment did not affect the Control Group, the interventions that were described were only used by the Experimental Group. The Facebook page where the group could engage one another on and off shift was a “closed group” and only the Experimental Group and the site administrator could allow access to it. In addition, any meetings that the Experimental Group had were duplicated with the Control Group yet the interventions were not

used or discussed in the meetings with the Control Group. This provided an adequate placebo effect for those who were part of the Control Group. Other than the treatment, both groups were treated similarly and worked in the same conditions.

Pilot Study Research Questions

Research Question 1: To what extent does the use of social media for informal workplace learning affect nonconformance (internal and external) metrics of this organization?

- **Null Hypothesis:** The use of social media for informal workplace learning had no effect on nonconformance (internal and external) metrics of this organization.
- **Alternate Hypothesis:** The use of social media for informal workplace learning had an effect on nonconformance (internal and external) metrics of this organization.

Research Question 2: To what extent does the use of social media for informal workplace learning affect on time delivery (OTD%) metrics of this organization?

- **Null Hypothesis:** The use of social media for informal workplace learning had no effect regarding on time delivery (OTD%) metrics of this organization.
- **Alternate Hypothesis:** The use of social media for informal workplace learning effected on time delivery (OTD%) metrics of this organization.

Pilot Study Data Collection

Data involving nonconformances and delivery rates was available for over 60 months prior to the treatment for all participants (Experimental and Control). Of those 60 months available, the previous 24 months of data was used to calculate a pre-treatment (Pretest) mean in both MRDR and Cognos. Data from the MRDR was reported separately from that of Cognos.

15 participants were used in the Early Research Preliminary Study as the experimental group. The remainder of the team served as the Control Group and involved 19 employees. As a part of the Experimental Group, those participants were allowed to use social media as described in the previous section whereas the Control worked with no changes in their daily routines. The data collection is automated and left in raw form as before the study so the Control Group was not aware of the data collection. After 3 months, the mean from the post-treatment (posttest) months were queried from the MRDR and Cognos systems and compared to the pre-treatment (pre-test) using Paired T Test for both groups. The same building, equipment, climate, supervision and management were used for both the Experimental and Control Groups. Data was collected simultaneously for both groups using the same automated system described previously.

Pilot Study Findings

Data from MRDR and Cognos involving the Experimental group is contained in Table 3.1 below.

	MM2 Experimental Employee Data							
	PPM MRDR		PPM Cognos		Delivery MRDR		Delivery Cognos	
Employee ID	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean
1	1123	911	1148	899	96.7	99.2	96.6	99.1
2	1201	842	1241	846	98.2	99.3	98.0	99.4
3	1064	802	1095	812	94.6	98.2	95.1	98.5
4	1102	697	1148	709	95.4	98.6	95.2	98.5
5	1349	927	1344	914	96.6	99.1	96.9	99.2
6	1277	818	1291	827	97.4	99.4	97.3	99.5
7	1191	806	1183	814	98.1	99.5	97.9	99.5
8	901	712	904	703	96.9	98.6	97.1	98.8
9	1021	747	1020	722	97.3	98.9	97.2	99.0
10	1164	624	1240	618	98.1	99.4	97.9	99.3
11	967	519	1004	524	96.4	98.8	96.4	98.9
12	1105	728	1110	736	97.2	99.2	97.3	99.1
13	1213	797	1242	801	97.6	98.9	97.4	99.2
14	1046	641	1031	653	98.1	99.0	97.9	99.2
15	1304	807	1314	808	97.4	98.9	97.2	98.7
SD	125.36	109.02	127.50	106.80	1.03	0.36	0.90	0.32
Mean	1135.20	758.53	1154.33	759.07	97.07	99.00	97.03	99.06
Cumulative	17028.00	11378.00	17315.00	11386.00	1456.00	1485.00	1455.40	1485.90

Table 3.1

Pilot Study Data Analysis

Upon completion of a T-Test analysis involving both Research Questions, a comparison of the critical t-value and the calculated t-statistic was completed. If the calculated t-statistic is greater than the critical t-value, the test will show that there is a statistically significant difference between the two populations of data. In this case, the null hypothesis was rejected. If no statistically significant difference is found between the two populations of data, the test will fail to reject the null hypothesis. Scores was reported in percentage gain of loss for either of the quality assurance metrics (in the form of internal and external rejection rates) in parts per million (PPM) and on time delivery % (OTD%).

Results of Pilot Study

Experimental Group Data

PPM is reported in actual values where delivery is reported in percentages (%)

Results from data analysis of Experimental Group using Paired T- Test follows:

Data: PPM MRDR

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest PPM MRDR minus posttest PPM MRDR equals 376.67

95% confidence interval of this difference: From 320.38 to 432.95

Intermediate values used in calculations:

t = 14.3525

df = 14

standard error of difference = 26.244

Group	Pretest PPM MRDR	Posttest PPM MRDR
Mean	1135.20	758.53
SD	125.36	109.02
SEM	32.37	28.15
N	15	15

Data: PPM Cognos

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest PPM Cognos minus posttest PPM Cognos equals 395.27

95% confidence interval of this difference: From 335.44 to 455.10

Intermediate values used in calculations:

t = 14.1691

df = 14

standard error of difference = 27.896

Group	Pretest PPM Cognos	Posttest PPM Cognos
Mean	1154.33	759.07
SD	127.50	106.80
SEM	32.92	27.58
N	15	15

Data: Delivery MRDR

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus posttest Delivery MRDR equals -1.933

95% confidence interval of this difference: From -2.364 to -1.503

Intermediate values used in calculations:

t = 9.6361

df = 14

standard error of difference = 0.201

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	97.067	99.000
SD	1.027	0.357
SEM	0.265	0.092
N	15	15

Data: Delivery Cognos

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus posttest Delivery MRDR equals -2.033

95% confidence interval of this difference: From -2.399 to -1.668

Intermediate values used in calculations:

t = 11.9369

df = 14

standard error of difference = 0.170

Group	Pretest Delivery Cognos	Posttest Delivery Cognos
Mean	97.027	99.060
SD	0.896	0.325
SEM	0.231	0.084
N	15	15

Control Group Data

Data from MRDR and Cognos involving the Control group is contained in Table 3.2 below.

MM2 Control Employee Data

Employee ID	PPM MRDR Pre Treatment Mean	PPM MRDR Post Treatment Mean	PPM Cognos Pre Treatment Mean	PPM Cognos Post Treatment Mean	Delivery MRDR Pre Treatment Mean	Delivery MRDR Post Treatment Mean	Delivery Cognos Pre Treatment Mean	Delivery Cognos Post Treatment Mean
1	932	1080	1111	1002	97.4	98.1	97.6	97.9
2	1125	949	939	950	96.9	97.1	96.5	97.1
3	1057	967	1093	1009	97.8	98.4	97.8	98.2
4	1084	998	1085	1043	99.0	97.2	99.2	97.1
5	960	1032	1139	1148	98.2	98.5	98.4	98.2
6	1119	1068	1071	1003	98.4	98.0	98.2	98.3
7	1168	1086	993	1183	97.7	98.1	97.5	98.0
8	955	954	1170	1191	95.9	94.8	95.9	94.9
9	1020	1062	1083	1062	98.2	98.5	98.1	98.6
10	1199	1138	1048	1059	97.2	97.1	97.4	97.3
11	1121	1130	913	1046	98.3	98.5	98.5	98.3
12	1029	1010	1161	1177	97.8	97.9	97.7	97.7
13	1137	1190	1123	1104	98.1	99.2	98.3	99.1
14	1131	1142	1143	1084	97.0	97.5	97.4	97.4
15	1118	1130	1051	1078	96.8	97.1	97.1	97.3
16	1135	1048	926	945	97.1	97.0	97.2	97.5
17	1023	1106	989	1011	98.1	98.2	98.2	98.3
18	1170	1178	938	1051	96.5	97.0	96.7	97.2
19	1061	976	1135	1183	94.5	95.0	94.6	95.3
SD	77.39	75.52	84.59	77.22	1.04	1.13	1.05	1.03
Mean	1081.26	1065.47	1058.47	1069.95	97.42	97.54	97.49	97.56
Cumulative	20544.00	20244.00	20111.00	20329.00	1850.90	1853.20	1852.30	1853.70

Table 3.2

PPM is reported in actual values where delivery is reported in percentages (%)

Data: PPM MRDR

P value and statistical significance:

The two-tailed P value equals 0.3879

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest PPM MRDR minus Posttest PPM MRDR equals 15.79

95% confidence interval of this difference: From -21.70 to 53.28

Intermediate values used in calculations:

t = 0.8849

df = 18

standard error of difference = 17.844

Group	Pretest PPM MRDR	Posttest PPM MRDR
Mean	1081.26	1065.47
SD	77.39	75.52
SEM	17.75	17.33
N	19	19

Data: PPM Cognos

P value and statistical significance:

The two-tailed P value equals 0.5077

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest PPM Cognos minus Posttest PPM Cognos equals -11.47

95% confidence interval of this difference: From -47.14 to 24.19

Intermediate values used in calculations:

t = 0.6759

df = 18

standard error of difference = 16.976

Group	Pretest PPM Cognos	Posttest PPM Cognos
Mean	1058.47	1069.95
SD	84.59	77.22
SEM	19.41	17.71
N	19	19

Data: Delivery MRDR

P value and statistical significance:

The two-tailed P value equals 0.4301

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus Posttest Delivery MRDR equals -0.121

95% confidence interval of this difference: From -0.436 to 0.194

Intermediate values used in calculations:

t = 0.8072

df = 18

standard error of difference = 0.150

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	97.416	97.537
SD	1.038	1.128
SEM	0.238	0.259
N	19	19

Data: Delivery Cognos

P value and statistical significance:

The two-tailed P value equals 0.6365

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus Posttest Delivery MRDR equals -0.074

95% confidence interval of this difference: From -0.396 to 0.248

Intermediate values used in calculations:

t = 0.4807

df = 18

standard error of difference = 0.153

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	97.489	97.563
SD	1.046	1.031
SEM	0.240	0.237
N	19	19

Conclusions

The mean values of the quality and delivery means Pretest for both the Experimental and Control Groups were nearly identical yet the results after treatment would show significant differences. The results of the T Test show that the Experimental Group experienced a statistically significant change between the Pretest and Posttest of this study rejecting the null hypothesis. At the same time, the data from the Control Group during the same period shows that the null hypothesis could not be rejected. This indicates that there was no statistical

difference in results between Pretest and Posttest indicating that the intervention of social media for learning was effective for an improvement in both quality and delivery metrics involving the Experimental Group. In Table 3.3 below, there is a list of the commonly accepted P-Values and how they correspond to whether there is a statistically significant difference in pretest and posttest data:

P > 0.10 No evidence against the null hypothesis. The data appear to be consistent with the null hypothesis.
0.05 < P < 0.10 Weak evidence against the null hypothesis in favor of the alternative.
0.01 < P < 0.05 Moderate evidence against the null hypothesis in favor of the alternative.
0.001 < P < 0.01 Strong evidence against the null hypothesis in favor of the alternative.
P < 0.001 Very strong evidence against the null hypothesis in favor of the alternative.

Table 3.3

As the results indicate, the Experimental Group data shows all results for P-Value are <0.0001 indicating very strong evidence against the null hypothesis in favor of the alternative. The Control Group data showed a P-Value range from 0.3879-0.6365, clearly indicating that there is no evidence against the null hypothesis.

To further show the differences between the Experimental and Control groups, the data was compared side by side (See Graphs A-D below) to give a graphical comparison showing the effects of the treatment from pretest and posttest periods.

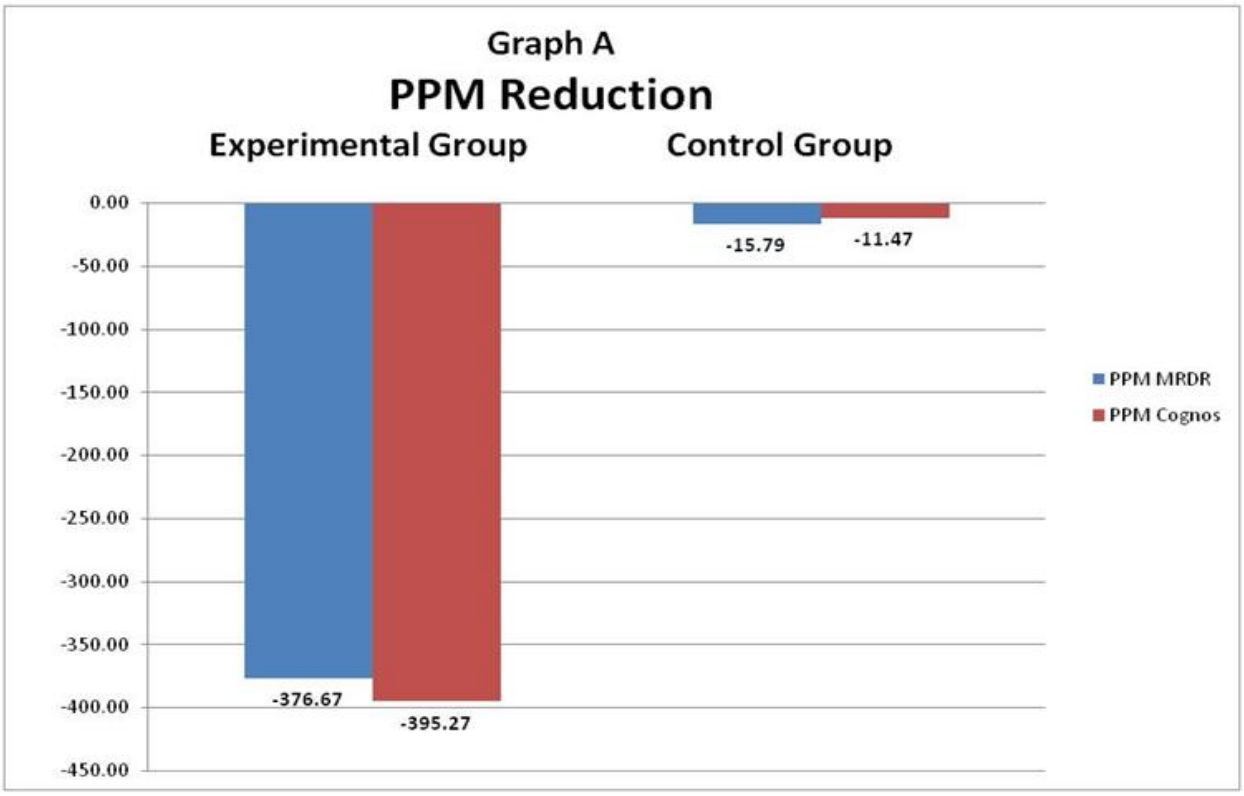


Figure 3.1

Figure 3.1 shows the difference between the Experimental and Control Groups in regard to the effect of the treatment on quality performance. Quality performance is typically reported in terms of Parts per Million (PPM). The higher a value for PPM, the lower the quality performance is. The goal for any workplace is to reach a 0 PPM. The following graph shows the effect of the treatment in the change of PPM from Pretest conditions to Posttest conditions. Although both groups experienced a reduction in PPM in that period, the Experimental Group saw an average reduction of 376.67 PPM reported through the MRDR system and a 395.27 PPM reduction reported through the Cognos system. The Control Group saw an average reduction of 15.79 PPM reported through the MRDR system and an 11.47 PPM reduction reported through the Cognos system.

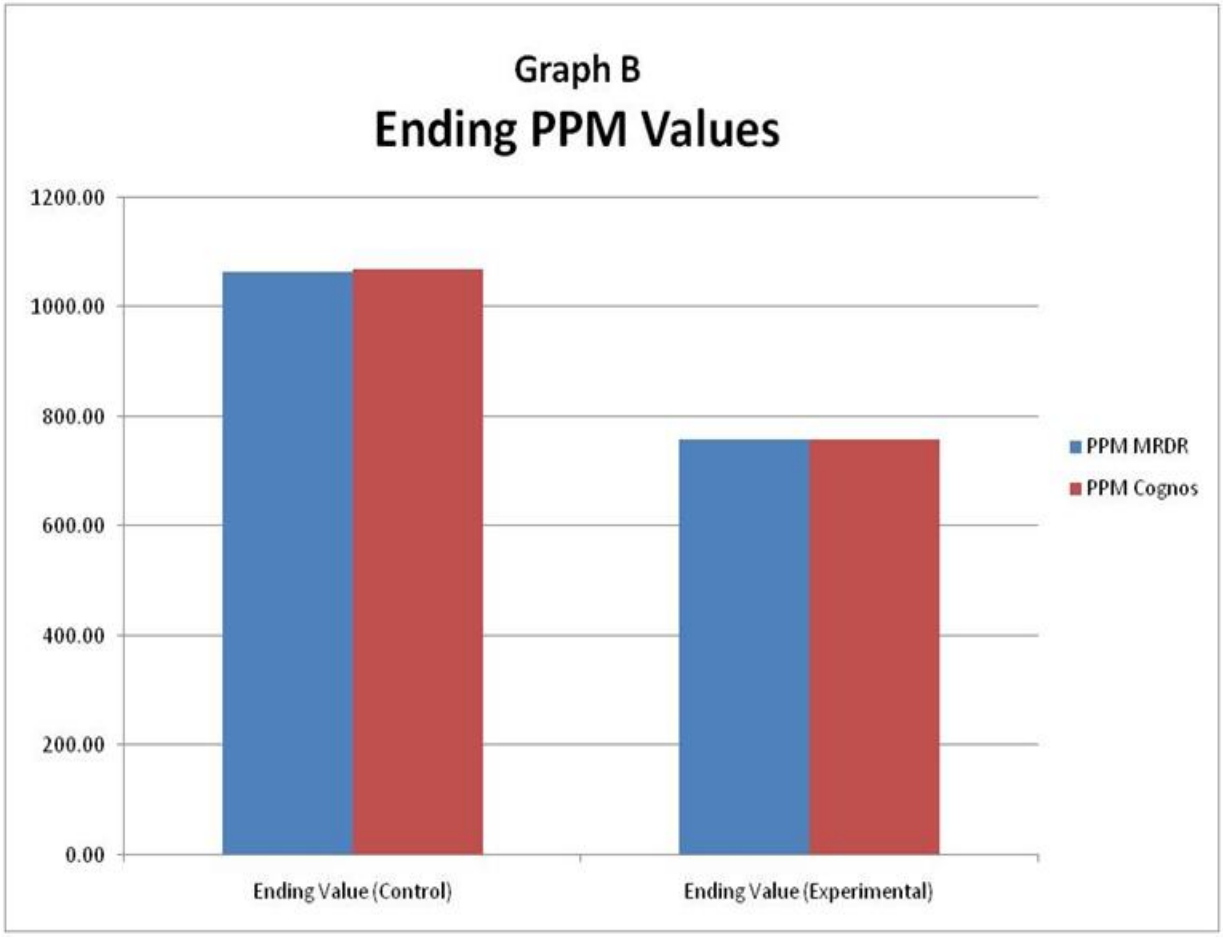


Figure 3.2

Figure 3.2 shows the actual ending value after the treatment. The lower the number, the better the quality performance is. In this example, the Experimental Group recorded a final PPM mean value though the MRDR system of 758.53 and a value of 759.07 through the Cognos system. In the same period, the Control Group recorded a final PPM mean value though the MRDR system of 1065.47 and a value of 1069.95 through the Cognos system.

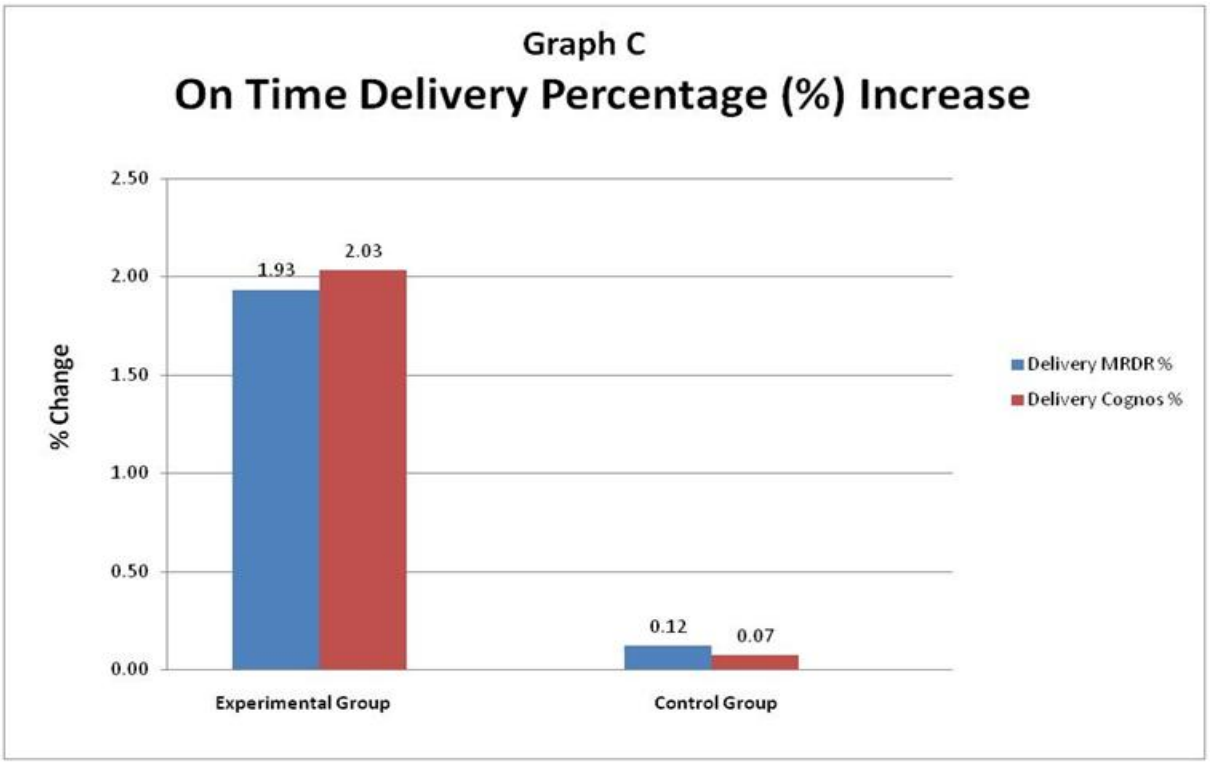


Figure 3.3

Figure 3.3 shows the difference between the Experimental and Control Groups in regard to the effect of the treatment on delivery performance. Delivery performance is typically reported in terms of on time delivery percentage (OTD%). The higher a value for OTD%, the higher the delivery performance is. The goal for any workplace is to reach a 100% OTD%. The following graph shows the effect of the treatment in the change of delivery from Pretest conditions to Posttest conditions. Although both groups experienced an increase in OTD% in that period, the Experimental Group saw an average increase of 1.93% reported through the MRDR system and a 2.03% reduction reported through the Cognos system. In the same period, the Control Group saw an average increase of 0.12% reported through the MRDR system and a 0.07% increase reported through the Cognos system.

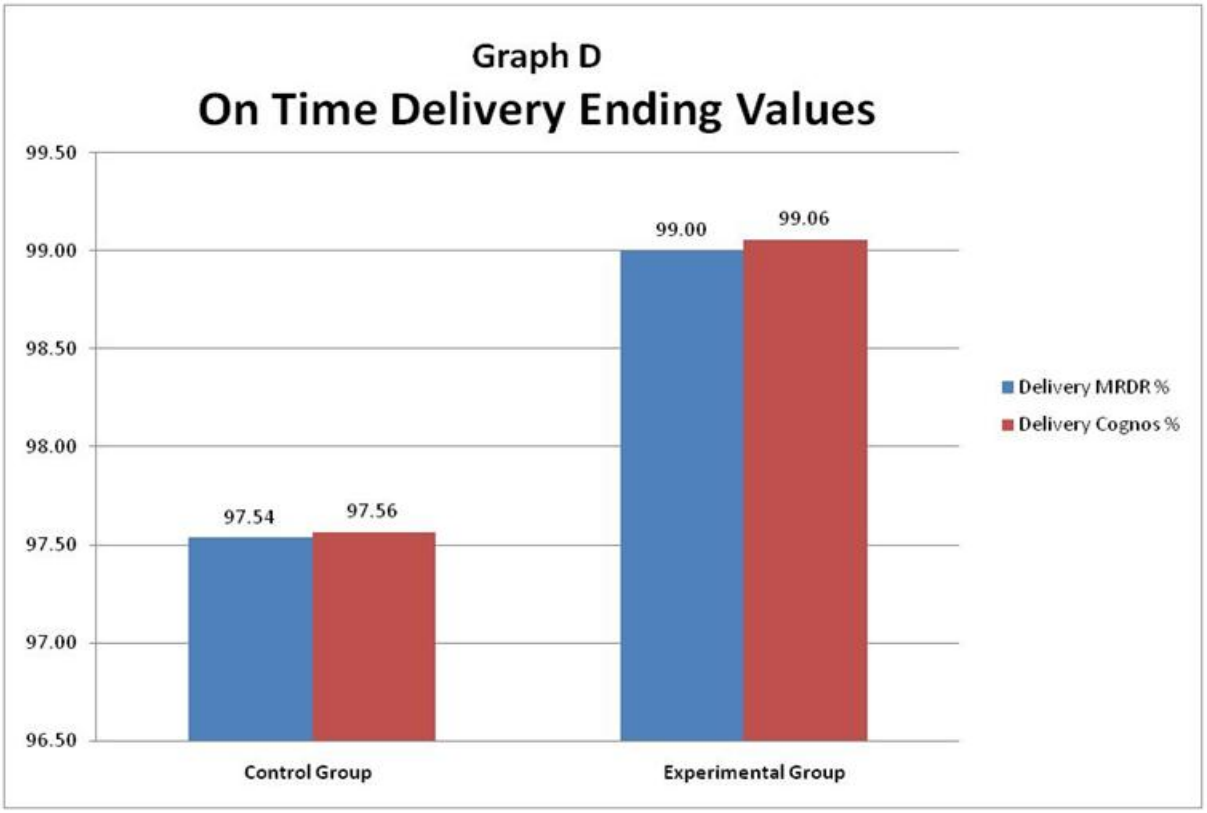


Figure 3.4

Figure 3.4 shows the actual ending value after the treatment. The higher the number, the better the delivery performance is. In this example, the Experimental Group recorded a final On Time Delivery% mean value though the MRDR system of 99.00 and a value of 99.06 through the Cognos system. In the same period, the Control Group recorded a final OTD% mean value though the MRDR system of 97.54 and a value of 97.56 through the Cognos system. In comparison, the pretest data showed the Experimental Group recorded a pretest On Time Delivery% mean value though the MRDR system of 97.07 and a value of 97.03 through the Cognos system. In the same period, the Control Group recorded a final OTD% mean value though the MRDR system of 97.42 and a value of 97.49 through the Cognos system. The results show that while the Experimental Group saw an increase in the delivery performance as reported

by both data collection systems, the Control Group experience a negligible amount of improvement.

The results from this study clearly show that there is a statistical difference in performance metrics when the use of social media for learning takes place in the work environment. The results reject the null hypothesis for both research questions showing that the introduction of social media in their learning process showed a relationship to quality and delivery performance. Although this research shows a relationship, there are clearly more opportunities for explore these relationships at a deeper level. Unfortunately, there are many gaps in current available research and the infancy of social media in the workplace leaves significant room for future research. The research contained in this study is a small part of what could be discovered through more deeply examining these relationships. Future research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can significantly lead to additional studies examining these relationships while using the same methodologies but on a larger scale. The results from that research will aid many organizations in the decision to use social media in their organizations, resulting in more effective training and better performance in the global economy.

Analysis

Strengths

This research study allowed for the evaluation of the treatment and its effect on quality and delivery metrics in a very simple and accessible way in an organization that has a number of business units to experiment with. Although there were a number of statistical methods that could have been used, the use of the Paired T-Test to compare the two means (Pretest and

Posttest results) of each of the groups (Control and Experimental) served in an efficient and accurate way to determine if the treatment had any measurable effect. Research while deciding which statistical tool to use for this study showed that the Paired T-Test would be the best match for the work that was being completed as a part of this research. The Soloman Four-Group Design was also considered but dividing a single work division into 4 equivalent subgroups that would be large enough to offer validity to the research was impractical if not impossible.

Since the employees in both the experimental group and control group work in the same conditions with the same supervisors and managers, the variables between the groups is greatly reduced. The threat of history as a risk was controlled by having the experimental and control group operate in similar environments over the same period of time. At the same time, as a result of the proximity of the experimental and control groups, additional risks (see Weaknesses below) may been introduced. Intrasession history is also eliminated as a threat as the data collection from both groups is done automatically through the MRDR (Material Rejection & Disposition Report) and Cognos system. The use of multiple researchers is not needed for successful completion of this research as a result of the automatic collection of multiple forms of data. The existence of abundant amounts of historical data is present and can give a strong baseline to compare pretreatment to posttreatment. Since the data is continuously being gathered in an automatic means and electronically, there is little chance of error as a result of data collection or interpretation or either historical data or data collected after treatment.

Weaknesses

The most obvious weakness is that there is no clear way of knowing which of the different forms (or combination of) of social learning caused the effect. There are 5 different avenues that could be the causative agent in the research. As a result, research moving forward

could refine the study to a lesser number of forms of social media to evaluate which of the five social media platforms used in the early research study was most effective.

Another weakness with this research setting is that experimental and control groups work very closely together and the control group most likely understands that their fellow coworkers who are part of the experimental group are allowed to use social media as a part of their daily jobs whereas they are not allowed to access these platforms. This may lead to skewed data and perhaps some resentment of the control group causing abnormally high nonconformance rates and reduced delivery rates. Although this was not observed in this research study, the potential is present. This situation increases the likelihood of interaction of selection and treatment. The control and experimental groups are from the same work area of the same division minimizing this effect since the work environment, supervision and management team are the same for both groups. Although this may be considered a potential risk to the study, the setting treatment interaction concerns will likely be minimal and the environmental conditions or settings under which a future study may be conducted will not likely be capable of being adequately duplicated in other settings. The experimental and control groups may or may not interact between one another but this interaction is not likely to affect the research results and is mitigated through Placebo Control.

Lessons Going Forward

The early research study provided a number of areas that could be improved upon moving forward. As discussed previously, the narrowing of the field to one or two of sources of social media that can be used as a platform can be reduced to evaluate its effect on quality and delivery metrics. Of those sources identified, the use of YouTube for problem solving was allowed and encouraged will be used in the larger study, reducing the focus of social media to

one variable. Improptu feedback from some of the individuals that took part in the study clearly showed that the use of Twitter was comfortable and beneficial to the employees and used significantly more than the others that were available in the Pilot Study. In future research, finding two business units that are similar in terms of longevity, experience and management would be ideal to ensure that communication between the experimental and control groups is kept to a minimum. Unfortunately, within the organization where these business units would be located, it is common for employees to interact between business units so the risk of the interaction between the experimental and control groups is a constant risk. Although not a perfect experimental setting, breaking members up in the same business unit into an experimental and control group offers the least amount of uncontrollable variables. The execution of this research in this manner would be able to further determine if the use of these two social media platforms can have a direct impact on the performance of an organization.

CHAPTER 4—EMPIRICAL STUDY

Research Design (Post-Pilot Study)

As a result of the findings of the Pilot Study, some changes were made to the Research Design for the main research study. Because there is no way to identify which of the social media treatments led to the measured changes described below, the research design moving forward will only include a single variable. In addition, this study now uses a mixed methods (Tashakkori & Teddlie, 2003) design, which is a procedure for collecting, analyzing and blending both quantitative and qualitative data at some stage of the research process within a single study, to understand a research problem more completely (Creswell, 2002). The rationale for using a mixed methods design is to address the issue where neither quantitative nor qualitative methods are adequate alone to capture the complex details that can be discovered during this research study. When used in combination, quantitative and qualitative methods complement each other and allow for more complete analysis (Green, Caracelli, & Graham, 1989, Tashakkori & Teddlie, 1998). Although it was more time consuming, the use of this design yielded far better results than only one of the methods alone. The analysis of the open ended questions that are part of the anonymous survey were administered after the research study was concluded to offer insights into how the employees that took part of the study comprehend the potential effects of the study. The survey had two main sections including a Likert scale response section that were analyzed quantitatively and the open ended questions that were analyzed qualitatively. The results from this survey also offered a venue for the study participants to have a voice to their likes, dislikes and general observations of the research study.

Appropriateness of the Research Design

In quantitative research, a researcher is focused on numerical data (Charles & Mertler, 2002). The researcher will use post positivist claims for developing knowledge, such as cause and effect thinking, reduction to specific variables, hypotheses and questions, use of measurement and observation, and the test of theories (Creswell, 2002). The research separates variables and then relates the separate data, if possible, to determine the significance and occurrence of those relationships. In addition, the researcher determines which variables to investigate and can choose further test methods to refine the results and to produce a highly dependable and valid research product.

On the other hand, qualitative research is "an inquiry process of understanding" where the researcher develops a "complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting" (Creswell, 1998, p. 15). In this approach, the researcher makes knowledge claims based on constructivist (Guba & Lincoln, 1982) or advocacy/participatory (Mertens, 2003) assessments. In qualitative research, data is collected from those who are a consistent and active participant in the setting in which the study applies. Data analysis is based on the values that these participants perceive for their world. Ultimately, it "produces an understanding of the problem based on multiple contextual factors" (Miller, 2000). Creswell (2003) describes this form of data collection as

> open-ended information that the researcher gathers through interviews with participants. The general, open-ended questions asked during these interviews allow the participants to supply answers in their own words. Also, qualitative data may be collected by observing participants or sites of research, gathering documents from a private (e.g., diary) or public (e.g., minutes of meetings) source, or collecting audiovisual materials such as videotapes

> or artifacts. The analysis of the qualitative data (words or text or images) typically follows the path of aggregating the words or images into categories of information and presenting the diversity of ideas gathered during data collection (p.172).

In a mixed methods approach, the researchers build the knowledge on pragmatic grounds (Creswell, 2003; Maxcy, 2003) asserting truth is "what works" (Howe, 1988, p.12). The researcher chooses the proper approaches, as well as variables and units of analysis, which are most appropriate for finding an answer to their research question (Tashakkori &Teddlie, 1998). A major assumption this kind of data collection is that quantitative and qualitative methods are usually compatible and will complement one another for a more robust and revealing result. Often, researchers erroneously believe that a mixed approach to a study is confusing and will result in substandard results. Unfortunately, because of these assumptions, many research opportunities could be more encompassing if the researcher would engage in the mixed methods approach (Brannan, 2015, p. 261). Creswell further describes the value of this approach by stating that by

> mixing the datasets, the researcher provides a better understanding of the problem than if either dataset had been used alone. There are three ways in which mixing occurs: merging or converging the two datasets by actually bringing them together, connecting the two datasets by having one build on the other, or embedding one dataset within the other so that one type of data provides a supportive role for the other dataset. In short, it is not enough to simply collect and analyze quantitative and qualitative data; they need to be "mixed" in some way so that together they form a more complete picture of the problem than they do when standing alone (2003, p.175).

The terms ‘mixed method’ design, ‘multimethod’ design and ‘multiple method’ design are very often used interchangeably. However, it is important to distinguish these terms. Tashakkori and Teddlie (2003, p. 11) define multiple method as “research in which more than one method or more than one worldview is used”. They define at least three broad categories of these multiple methods: the multimethod research, mixed method research, and mixed model research. From the analysis of Tashakkori and Teddlie (2003) we have further evidence that the distinction among these methods is related to the research stage of the study (described by definition of research questions, research methods, data collection and analysis, and the inference process) where the mix of methods is used. Morse provides the further enhances the definitions for multimethod and mixed method designs below:

- Multimethod design – this is the conduct of two or more research methods, each conducted thoroughly and complete in its own right, in one project. The results are then triangulated to form a complete concept of the information being collected and presented.
- Mixed methods design – this is the combination of various qualitative and quantitative approaches within a single project that may have either a qualitative or quantitative needs in the collection. In these cases, one of the approaches will be dominant leaving the residual research to be imported to make a more complete and robust picture. In these cases, the imported data will serve as supplemental to the major or core method and serve to enlighten or provide clues that are followed up within the core method (2003, p. 190).

Morse continues by clarifying that the term research project refers to a research study focusing in one research question, while research program refers to a collection of similar and

related research projects. According to Morse (2003), the major difference between multimethod and mixed method design is that when working with a multimethod design, all individual projects within the study are complete in themselves whereas the mixed method assumes the use of all forms of data collection to be used and presented. Tashakkori and Teddlie (2003) propose the term mixed model research to represent the mixed combination of methods in many or all the stages of the study.

This study will use one of the most popular mixed methods designs in educational research: the multimethod research (Morse, 2003). This kind of data collection took a pragmatic approach allowing the best research model(s) that will answer the research questions and use a combination of the methods to express complementary strengths and non-overlapping weaknesses. This study will collect, analyze, and mix multiple forms of either qualitative or quantitative data. The main focus of this research study was to capture the quantitative data in the form of results that were reported within the Material Rejection & Disposition Report (MRDR) and Cognos Report were used to compare to the past 2 years of data of similar time of the year and same processes. An anonymous survey was administered to willing participants of the experimental group after the data collection from MRDR and Cognos posttreatment has taken place. The results of Likert scale survey data was analyzed quantitatively to get a deeper perspective into the study participants' experience and insights from the study. To capture the qualitative data, the use of open-ended questions from the survey was also used. This information was analyzed to further get a deeper perspective into the study participants' experience and insights from the study.

Revised Research Questions

As a result of lessons learned during the Pilot Study, the broad use of social media was reduced to only one variable, as described above. The research questions were also revised to reflect the study. The research questions that are relevant to the Pilot Study are located above in the Pilot Study section.

Research Question 1: To what extent does the use of Twitter for workplace learning affect nonconformance (internal and external) metrics of this organization?

- **Null Hypothesis:** The use of Twitter for workplace learning had no effect on nonconformance (internal and external) metrics of this organization.
- **Alternate Hypothesis:** The use of Twitter for workplace learning had an effect on nonconformance (internal and external) metrics of this organization.

Research Question 2: To what extent does the use of Twitter for workplace learning affect on time delivery (OTD%) metrics of this organization?

- **Null Hypothesis:** The use of Twitter for workplace learning had no effect regarding on time delivery (OTD%) metrics of this organization.
- **Alternate Hypothesis:** The use of Twitter for workplace learning effected on time delivery (OTD%) metrics of this organization.

Quantitative Research

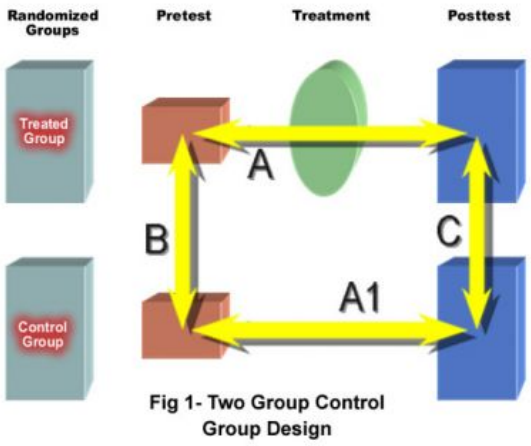
The largest portion of the study used a True Experimental, Pretest Posttest Control Group (Zientek, Nimon, & Hammack-Brown, 2016; Campbell, Stanley, & Gage, 1966) research model

for the majority of the quantitative research segment. Some of the most respected research in human resource development enlists the use of hypotheses and use true experimental designs. Zientek, Nimon, & Hammack-Brown explain how

> A somewhat typical experimental design would involve collecting pretest and posttest data on individuals assigned to a control or experimental group. Data from such a design that considered if training made a difference in knowledge, skills or attitudes, for example, could help advance practice. Using simulated datasets, situated in the example of a scenario-planning intervention, this paper aims to show that choosing a data analysis path that does not consider the associated assumptions can misrepresent findings and resulting conclusions (2016, p. 642).

Considering the relationship to be examined in this research deals directly effect of a specific form of training (through the use of social media) and quality and delivery performance as a result of employee performance, this research methodology is a perfect fit to examine the gaps in the currently available research that have been shown to exist in literature. An example of how this process will develop to be used as the design for this research is below. Martyn Shuttleworth describes the basic design of the Pretest Posttest Control Group design.

Figure 4.1



- This design allows researchers to compare the final posttest results between the two groups, giving them an idea of the overall effectiveness of the intervention or treatment. (C)
- The researcher can see how both groups changed from pretest to posttest, whether one, both or neither improved over time. If the control group also showed a significant improvement, then the researcher must attempt to uncover the reasons behind this. (A and A1)
- The researchers can compare the scores in the two pretest groups, to ensure that the randomization process was effective. (B) (2016)

In this study, the same sample of employees were used for the pre-intervention and the post-intervention. The intervention is the introduction of social media into the learning employee/development program. Social media in the learning employee/development included:

- The use of Twitter for problem solving and collaboration was allowed and encouraged using anonymous private Twitter accounts to ensure only the members of the Experimental Group participated through its use. The use of direct messaging through these private Twitter accounts also can add an additional layer of anonymity to the group and its use was encouraged in the Experimental Group.

The study lasted for approximately 3 months from May 21, 2018 to August 12, 2018. The previous 2 years of data was used for the pre-intervention baseline followed by 3 months of social media for learning employee/development serving as the intervention. Data was collected

post-intervention in the same manner from the two systems as pre-intervention as described previously (automatically).

A flowchart of the steps used in this portion of the study can be found below.

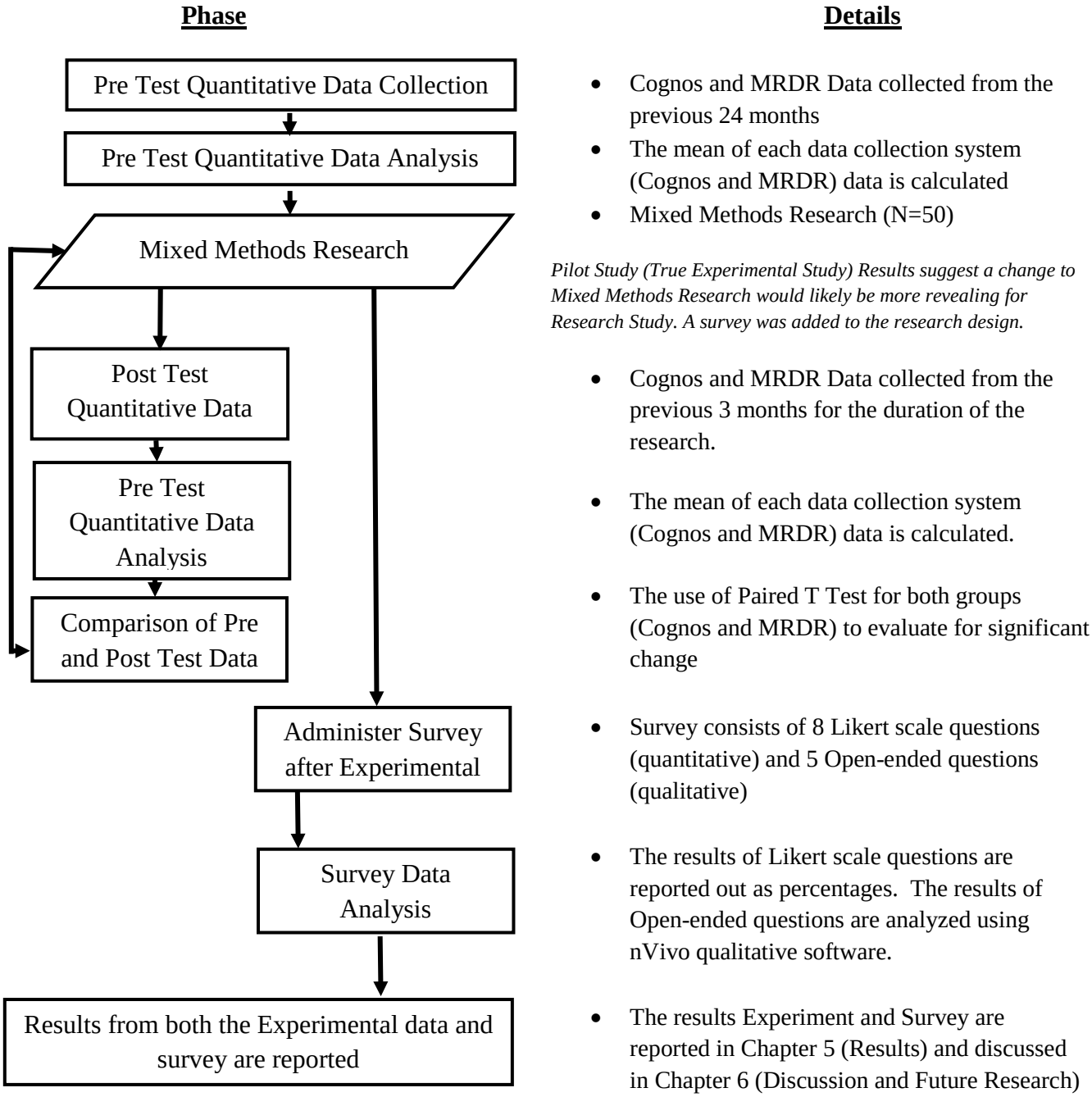


Figure 4-2. Detailed diagram of explanatory Mixed Methods research model used for this study.

Target Population and Research Sample

The manufacturing setting is a Fortune 50 corporation that has a number of facilities formed into smaller, semi-independent business units. The significance of the business units structure in this case is the broad variability of the use of learning tools and methods between them, ranging from tribal and tacit knowledge (no clearly defined training program) as the main form of workplace learning to fully developed LMS systems with defined learning programs and job specific curricula that can be completed through Instructor Led Training (ILT) and web based learning including social media on mobile devices. This study was conducted within those business units that do not have a defined learning program present and do not use social media in the training /employee development program, particularly the Technical Center. This study used two groups from that business unit where the work environment, supervision and management team are the same for all employees and participants of the study. In addition, the participants of the experimental and control groups had similar in years of experience in their current role in the business unit.

Due to the proprietary nature of the organization this study was completed within, the organization is identified from this point forward as "Organization X". In the central Illinois area, Organization X has over 20 business units and 45 individual buildings. Worldwide, Organization X has over 110,000 employees. For this research, 1 business unit (4 buildings) will be examined with a total population of 200+ employees. All employees' delivery and quality metrics are captured on a continuous basis through two different databases, Cognos and MRDR. The business unit that will be used was chosen as a result of a lack of a defined learning program present yet has very complete and robust data collection capturing numerous metrics.

Resulting Sample

The recruitment process followed IRB (APPENDIX E) protocol and took approximately 2 weeks to complete from May 7, 2018 to May 18, 2018. A random sampling plan was used to identify potential participants in the study. Below are the main steps for the random sample:

1. Define the population: The population will be all employees in a division of the business unit. The population will be controlled by response to recruitment email (APPENDIX F). It was expected that 50-75% of employees will choose to participate in the study.
2. Choose the sample size: Sample size will be at 100 (Control and Experimental Groups combined – 50 in each group). This number may be modified (higher or lower) as a result of response to recruitment email.
3. List the population: A list of all employees agreeing to participate will be listed.
4. Assignment of numbers to employees who choose to be participants: Each of the employees agreeing to participate will be assigned a consecutive number from 1 to N (depending on employees agreeing to participate).
5. Using a random number generator in Excel, a list of random numbers will be generated to match the sample size of 100.
6. Those employees that were chosen as a result of the random number generator were invited to participate in the experimental research group or the control group.
7. After Experimental Group had been randomly selected, a meeting to assign Twitter User ID's and a list of related hashtags was held. Participants used Twitter ID's @TCLResearch1-@TCLResearch50. This identification was used to complete Twitter Analytics using Twitter Analytics Application (See section below discussing Twitter Analytics application). In addition to the Twitter ID's, each calibration cell within the

study was also identified using Twitter. This hashtag identification was also used to identify interaction involving specific calibration cells using Twitter Analytics. Below is a list of the Twitter Hashtags to be used in this study:

Hashtag to Be Used	Actual Name of Calibration Location
TCLCalCell1	Tech Center L Calibration Cell 1
TCLCalCell2	Tech Center L Calibration Cell 2
TCLCalCell3	Tech Center L Calibration Cell 3
TCLCalCell4	Tech Center L Calibration Cell 4
TCLCalCell5	Tech Center L Calibration Cell 5
TCLCalCell6	Tech Center L Calibration Cell 6
TCLCalCell7	Tech Center L Calibration Cell 6
TCLCalCell8	Tech Center L Calibration Cell 8
TCLCalCell9	Tech Center L Calibration Cell 9
TCGCalCell1	Tech Center G Calibration Cell 1
TCGCalCell2	Tech Center G Calibration Cell 2
TCGCalCell3	Tech Center G Calibration Cell 3
TCGCalCell4	Tech Center G Calibration Cell 4
TCGCalCell5	Tech Center G Calibration Cell 5
TCGCalCell6	Tech Center G Calibration Cell 6
TCGCalCell7	Tech Center G Calibration Cell 7
TCGCalCell8	Tech Center G Calibration Cell 8
TCACalCell1	Tech Center A Calibration Cell 1
TCACalCell2	Tech Center A Calibration Cell 2
TCACalCell3	Tech Center A Calibration Cell 3
TCACalCell4	Tech Center A Calibration Cell 4
TCACalCell5	Tech Center A Calibration Cell 5
TCACalCell6	Tech Center A Calibration Cell 6

Table 4.1

After agreeing to IRB (APPENDIX E) consent and to partake in study, signing the Social Behavioral Research Consent Form (APPENDIX G), a total of 50 employees were assigned to the experimental group (Detailed demographics to be discussed in Chapter 5). Once the approximately 3 month research study has been concluded, all employees who were part of the Experimental Group were asked to take the online survey (APPENDIX D). SurveyMonkey was used to host the online survey. A 100% response was anticipated however only 96% partook in

the survey. Since all employees in the organization must have a certain level of ability using technology to perform the day-to-day job functions, no bias in terms of those who may be more capable using technology was anticipated.

Data Collection

The majority of the data that was collected for this research came in the form of existing records or records that are collected from existing systems before and after the treatment. This form of data can offer a variety of details that may not be available in other forms. Public records are the type to be used in this research design. These records have been collected in the same way (automatically) for over 20 years, offering a deep history into the performance of the areas being researched. Although these records are by definition "public", they are company records of Organization X and are not offered for public consumption outside of the organization. The usefulness of existing sources of these documents is extraordinary as they are extremely accurate and readily accessible to anyone with the right to retrieve them. Advantages to using this kind of data include:

- Readily available with little to no lead time for access
- Inexpensive
- Available in common terminology that describes what is being measured accurately
- Provide information on historical trends or sequences
- Provide opportunity for study of trends over time
- Ability to be configured to a more useful form (i.e. Excel format, pivot tables, etc.)

Along with the above advantages, this form of data offers the following disadvantages:

- Analysis may be time consuming and access may be difficult

- Access in this organization is limited to employees only
- Acronyms and terminology in the reports can be confusing to reader unless identified in the early stages of report
- So much data is available that it may be overwhelming to researcher and reader if not filtered well

Quantitative Data

Quantitative data collected from all departments and processes in the business unit where the research is being conducted to measure quality assurance metrics (in the form of internal and external rejection rates) in parts per million (PPM) and on time delivery % (OTD%) in a manufacturing workplace through the MRDR and Cognos systems. Quantitative data was also collected from the online anonymous survey administered posttreatment from the Likert scale segment of the survey.

Data Analysis

To analyze the data from MRDR and Cognos systems, the use of the Paired T-Test was used to compare the two means (Pretest and Posttest results) of each of the groups (Control and Experimental). The T-Test assumes normal distribution that was provided from the test. The data used in this method has been and will continue to be collected through the MRDR (Material Rejection & Disposition Report) and Cognos systems within Organization X. There will be no change in the automated data collection process and the resulting data can be queried to meet any data collection need required. The usefulness of the T-Test is that is indicates whether or not the difference between two groups' means and reflects a likelihood of an actual difference in results from the Pretest and Posttest groups.

To analyze the data from the Likert scale section of the online anonymous survey, the use of an analyze function in SurveyMonkey was used. The results to be shared show the average response values of each of the Likert scale questions offered as part of the survey.

Twitter Analytics

In addition to Twitter being used as a venue for communication and collaboration during the research study, the use of the application, Twitter Analytics was used after the experimental phase of study had been concluded. The purpose of the use of this application is to see the interaction and engagement of the experimental participants through the use of Twitter. The examinations of critical relationships that emerged from the interaction using Twitter and reveal which users were the real influencers in the exchange of information during the study. In addition, this application also revealed which topics (Calibration Test Cells mentioned using the aforementioned hashtags) were most commonly Tweeted about allowing Organization X an opportunity to address potential training needs due to high volumes of communication about specific equipment and situations.

Internal and External Validity

Although the use of One Group Pretest Posttest was initially considered, this research model has a number of considerations that would make the validity of the research questionable. The Soloman Four-Group Design was also considered but dividing a single work division into 4 equivalent subgroups that would be large enough to offer validity to the research was impractical if not impossible. Once the Pretest Posttest Control Group experimental design had been decided upon, the method has some considerations that must be addressed such as the use of non-equivalent treatment and control groups. Although the Pretest Posttest Control Group design also presents this issue, these concerns can be dealt with successfully to overcome them with

minimal impact to the study results. Campbell, Stanley, & Gage explain that, "If there is not group equivalence it is still possible to ascertain the effects of the independent variable through changes in test scores (pretest and posttest). If the independent variable had an effect, experimental group will exhibit greater change" (1966, p. 24).

In addition to the considerations previously discussed, the following considerations will also reduce and/or remove threats that may compromise the validity of the research.

Potential internal threats are listed below:

- **History**-This is threat to be controlled by having the experimental and control group originate from similar environments over the same period of time. Intrasession history is also eliminated as a threat as the data collection from both groups is done automatically through the MRDR(Material Rejection & Disposition Report) and Cognos system. The use of multiple researchers is not needed for successful completion of this research.
- **Maturation and testing**- Since the experimental and control groups were measured in identical means, these areas of concern was eliminated.
- **Instrumentation**- Since the experimental and control groups were measured in identical means, these areas of concern was eliminated.
- **Regression**- Since the participants are from the same business unit, there should be no extremities that will cause significant changes in the results. The groups are equal in terms of work environment, supervision and management team.
- **Mortality**- Since the participants of the control and experimental groups are similar in years of experience, the mortality of these groups should be similar.

Potential external threats are listed below:

- **Interaction of testing and treatment**- since the pretest data is not known to the subjects as a result of data collected by the MRDR(Material Rejection & Disposition Report) and Cognos system occurs in the background, the research participants will not be biased by the data prior to the treatment.
- **Interaction of selection and treatment**- Although the control and experimental groups are working in the same business unit, this affect should be minimized since the work environment, supervision and management team are the same for both groups. The groups may or may not interact between one another but his interaction is not likely to affect the research results.
- **Reactive arrangements**- Although the control and experimental groups are from same business unit, this affect should be minimized since the work environment, supervision and management team are the same for both groups and the data collection process is automated and will not be able to influence the participants.

Triangulation

Data Source Triangulation provided evidence from more than one source. Data from MRDR is provided in a 24-hour cycle where the data is a result of end users to reporting nonconformances in terms of accuracy and delivery of results. The Cognos system is a real time system that is linked to the corporate-wide scheduling system that is constantly updating to inform team members of any delivery disruptions caused by delivery or quality situations. If a delivery has been made and inventory is still below prescribed levels, quality nonconformances are assumed to have taken place. Since both systems work independently from one another yet provide similar data, these results can be used for triangulation.

Qualitative Research

Qualitative data was collected using the open ended questions that are part of the online anonymous survey (APPENDIX D). The qualitative data was read carefully to discover common themes. From this information, coding categories were developed as a means of sorting the descriptive data collected so that the material bearing on a given topic could be physically separated from other data. The labeling of each response with one or more of the categories followed. During this labeling, two subcategories were added to provide clarity in the responses. The use of NVivo software was used to import the data, create emergent coding, and complete thematic analysis to better refine the results from these questions. NVivo was used nearly exclusively to complete the qualitative analysis due to the ease of use and robust functionality. The analyses of these findings are included in the Chapter 5.

Incentives

The incentive for employees to take part in the research study is paid time while they participate in each of the processes and the ability to contribute to the overall health of the business unit and organization. No other incentives were provided.

Ethical Considerations

According to Bryman and Bell, the following ten principles of ethical considerations have been compiled as a result of analyzing the ethical guidelines of nine professional social sciences research associations:

- Research participants should not be subjected to harm in any ways whatsoever.
- Respect for the dignity of research participants should be prioritized.
- Full consent should be obtained from the participants prior to the study.

- The protection of the privacy of research participants has to be ensured.
- Adequate level of confidentiality of the research data should be ensured.
- Anonymity of individuals and organizations participating in the research has to be ensured.
- Any deception or exaggeration about the aims and objectives of the research must be avoided.
- Affiliations in any forms, sources of funding, as well as any possible conflicts of interests have to be declared.
- Any type of communication in relation to the research should be done with honesty and transparency.
- Any type of misleading information, as well as representation of primary data findings in a biased way must be avoided (2007).

Institutional Review Board (IRB) approval (Appendix E) for this revised research study as described in this chapter has been obtained from the Office for the Protection of Research Subjects at the University of Illinois at Urbana – Champaign.

Summary

In Chapter 4, methodological issues were discussed, including participant sampling, instrumentation, data collection process, and data analysis for the revised research study. There is great value in the results of this study to examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in

terms of nonconformances and delivery rates. The Pilot Study clearly shows that there is a statistical difference in performance metrics when the use of social media for learning takes place in the work environment. The results of the Pilot Study reject the null hypothesis for both research questions showing that the introduction of social media in their learning process showed a relationship to quality and delivery performance. Although this research shows a relationship, there are clearly more opportunities for explore these relationships at a deeper level. This revised research study attempts to explore this relationship on a much deeper level using a mixed methods study.

Unfortunately, the extensive literature review indicates there is a lack of systematic research in the area of social media for use in workplace learning and the effect on quality and delivery metrics. These gaps in research leave significant room for future research. The research contained in this study is a small part of what could be discovered through more deeply examining these relationships. Future research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research will aid many organizations in the decision to use social media in their organizations, resulting in more effective training and better performance in the global economy.

CHAPTER 5

RESULTS

Introduction

This chapter presents the results of the experimental data and subsequent survey providing a foundation that is examined and discussed in more detail in Chapter 6 (Discussion and Future Research). This chapter is subdivided into a number of sections that are logically ordered to correspond with the sections of the experiment and survey so they can be clearly understood and followed in this chapter and Chapter 6. Many of the sections are repeated in the following chapter in the same order so the discussion can be followed in a similar way as this chapter. The purpose of this study was to examine the relationship, if any, between the use of social media (specifically the use of Twitter) for workplace learning through problem solving and collaboration and its effect on quality and delivery performance in a manufacturing environment. As discovered in Chapter 2, an extensive literature review indicates a lack of systemic research in this area and this research was completed to examine any potential relationship between the use of Twitter and manufacturing performance perhaps, filling some of the gaps that were discovered in the literature review. It may also offer a foundation to build future research in this area of employee development and manufacturing.

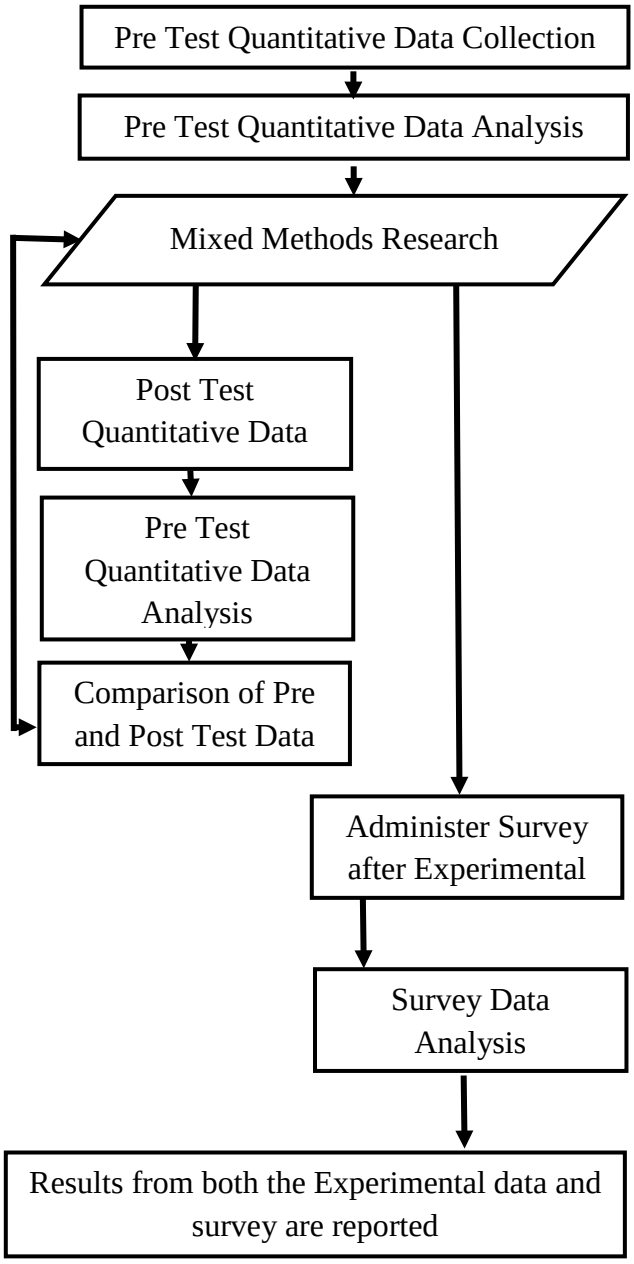
This research study used a mixed methods research model however, the majority and main component of the research was conducted as a controlled quantitative research study where data was collected before and after the intervention. In this research study, the same sample of employees was used for the pre-intervention and the post-intervention. The intervention is the introduction of social media into the learning employee/development program. Social media introduced as part of the learning employee/development were as follows:

- The use of Twitter for problem solving and collaboration was allowed and encouraged using anonymous private Twitter accounts to ensure only the members of the Experimental Group participated through its use. The use of direct messaging through these private Twitter accounts also can add an additional layer of anonymity to the group and its use was encouraged in the Experimental Group.

The study lasted for approximately 3 months, with the previous 2 years of data being used for the pre-intervention baseline, followed by approximately 3 months of social media though the use of Twitter for learning employee/development serving as the intervention. Data was collected post-intervention in the same manner as pre-intervention (automatically). Although the data can be manipulated once gathered, it was left in its unadulterated raw form for analysis. This data was later analyzed quantitatively later in this chapter.

Once the experiment was concluded, an online, anonymous survey was available to the members of the Experimental Group to complete. They were given one week from the end of the experiment to complete the survey. The survey was designed to answer questions to better understand how the experimental study was received and appreciated by the participants of the Experimental Group. The survey was broken down into two main sections: eight Likert scale questions and five open-ended questions. The Likert scale results were reported in raw data tables (later in this chapter) and in graphical form showing percentage of responses to the questions. The open-ended section results were reported showing the raw data (APPENDIX G) and in graphical form after being analyzed qualitatively using nVIVO software (later in this chapter). Word Clouds and Hierarchy Tables can be found in Appendix I and J, respectively. All results are further discussed in greater detail in Chapter 6.

A flowchart of the steps used in this study can be found below.



Details

- Cognos and MRDR Data collected from the previous 24 months
- The mean of each data collection system (Cognos and MRDR) data is calculated
- Mixed Methods Research (N=50)

Pilot Study (True Experimental Study) Results suggest a change to Mixed Methods Research would likely be more revealing for Research Study. A survey was added to the research design.

- Cognos and MRDR Data collected from the previous 3 months for the duration of the research.
- The mean of each data collection system (Cognos and MRDR) data is calculated.
- The use of Paired T Test for both groups (Cognos and MRDR) to evaluate for significant change
- Survey consists of 8 Likert scale questions (quantitative) and 5 Open-ended questions (qualitative)
- The results of Likert scale questions are reported out as percentages. The results of Open-ended questions are analyzed using nVivo qualitative software.
- The results Experiment and Survey are reported in Chapter 5 (Results) and discussed in Chapter 6 (Discussion and Future Research)

Figure 5-1. Detailed diagram of explanatory Mixed Methods research model used for this study.

Research Design

This study used a Mixed Methods research model.

Revised Research Questions

As a result of lessons learned during the Pilot Study, the use of several forms of social media was reduced to only one variable, as described above. The research questions were also revised to reflect this change. The research questions that are relevant to the Pilot Study are located in Chapter 3 in the Pilot Study section.

Research Question 1: To what extent does the use of Twitter for workplace learning affect nonconformance (internal and external) metrics of this organization?

- **Null Hypothesis:** The use of Twitter for workplace learning had no effect on nonconformance (internal and external) metrics of this organization.
- **Alternate Hypothesis:** The use of Twitter for workplace learning had an effect on nonconformance (internal and external) metrics of this organization.

Research Question 2: To what extent does the use of Twitter for workplace learning affect on time delivery (OTD%) metrics of this organization?

- **Null Hypothesis:** The use of Twitter for workplace learning had no effect regarding on time delivery (OTD%) metrics of this organization.
- **Alternate Hypothesis:** The use of Twitter for workplace learning effected on time delivery (OTD%) metrics of this organization.

RECRUITMENT

Target Population and Research Sample

The research setting is a Fortune 50 manufacturing corporation that has a number of facilities formed into smaller, semi-independent business units. The significance of the business units structure in this case is the broad variability of the use of learning tools and methods between them, ranging from tribal and tacit knowledge (no clearly defined training program) as the main form of workplace learning to fully developed LMS systems with defined learning programs and job specific curricula that can be completed through Instructor Led Training (ILT) and web based learning including the use of mobile devices. This study worked within one of those business units that does not have a defined learning program present and do not use social media in the training /employee development program, in particular, the Technical Center Campus (Tech Center). The Tech Center is comprised of 6 similar buildings completing ISO 17025 Accredited calibration and engine testing simulations. This research will focus on the quality and delivery of the calibrations being completed correctly to regulatory standard requirements and completed on time that support the work completed in the engine testing cells. This study used two groups from the same business unit and the same building (Building L) within the Tech Center campus where the work environment, supervision and management team are the same for both groups. All employees' delivery and quality metrics are captured on a continuous basis through two different databases, Cognos and MRDR. In addition, the participants are similar in years of experience in their current role in the business unit. The average tenure of an employee in the same job function in this facility is 13.46 years, making the employees' competence level extremely high.

Resulting Sample of Participants

The recruitment process followed IRB protocol and took approximately 2 weeks to complete from May 7, 2018 to May 20, 2018. A random sampling plan was used to identify and designate participants in the study. Below are the main steps for the random sample:

- Define the population: The population was all employees of the Technical Center Business Unit with over 350 employees in this business unit. The population was controlled by response to recruitment email (APPENDIX F). It was expected that 50-75% of employees would choose to participate in the study; however, 81% of the population (284 employees) agreed to participate in the study, if chosen to be used.
- Sample size: Sample size was 100 total participants (Control and Experimental Groups combined – 50 in each group).
- List the population: A list of all employees agreeing to participate was listed.
- Assignment of numbers to employees who choose to be participants: Each of the employees agreeing to participate was assigned a consecutive number from 1 to 284.
- Using a random number generator in Excel, a list of random numbers was generated to match the sample size of 100.
- Those employees that were chosen as a result of the random number generator were invited to participate in the experimental research group or the control group, alternating their placement per each consecutive number identified. Example: First number would place that employee in Experimental Group; the following number would place that employee in the Control Group, etc.

After all employees agreed to partake in study, they signed the Social Behavioral Research Consent Form (APPENDIX G), a total of 50 employees were assigned to the Experimental

Group and 50 to the Control Group. In the event that an employee had chosen not to participate in the study after being selected, another employee would have been selected using the process described above. No participants declined to be involved in the study and all remained in the study for the duration of the research (approximately 3 months from May 21, 2018 to August 12, 2018).

Detailed demographics of Participants
Demographic Information for Employees Agreeing to Participate in Research Study
(N=284)

	Demographic	Frequency (Percent of Study Participants)
Gender	Female	39%
	Male	61%
Age	18-21	2%
	22-25	10%
	26-30	29%
	31-40	48%
	41-50	10%
	51-60	1%
	61+	0%
Race	White (Non-Hispanic)	55%
	Black / African American	26%
	Asian	15%
	Hispanic	4%
	Other	0%
Education Level	No College	0%
	Associated Degree	5%
	Bachelors Degree	90%
	Masters Degree	5%
	Doctorate	0%
Years of Experience In Same Job Function	1-5 Years	3%
	6-10 Years	15%
	11-15 Years	64%
	12-20 Years	16%
	20+ Years	2%

Table 5.1

Demographic Information for Employees Selected for Research Study (N=100)

	Demographic	Frequency (Percent of Study Participants)
Gender	Female	41%
	Male	59%
Age	18-21	1%
	22-25	8%
	26-30	27%
	31-40	53%
	41-50	11%
	51-60	0%
	61+	0%
Race	White (Non-Hispanic)	58%
	Black / African American	28%
	Asian	12%
	Hispanic	2%
	Other	0%
Education Level	No College	0%
	Associated Degree	2%
	Bachelors Degree	92%
	Masters Degree	6%
	Doctorate	0%
Years of Experience In Same Job Function	1-5 Years	4%
	6-10 Years	12%
	11-15 Years	63%
	12-20 Years	19%
	20+ Years	2%

Table 5.2

Data Collection

The majority of the data that was collected for this research study came in the form of existing records or records that are collected from existing systems (MRDR and Cognos) before and after the treatment. This form of data offers a variety of details that may not be available in other forms. It is useful in raw form of can be made into a pivot table to do in-depth data mining. In this study, the data was used in raw form due to the simplicity of the analysis. That data has been included in the tables later in this chapter.

Quantitative Data

Quantitative data was collected from all departments and processes in Technical Center where the research was conducted to measure quality assurance metrics (in the form of internal and external rejection rates) in parts per million (PPM) and on time delivery % (OTD%) in a manufacturing workplace through the MRDR and Cognos systems. Data involving nonconformances and delivery rates was available for over 60 months prior to the treatment for all participants (Experimental and Control). Of those 60 months available, the previous 24 months of data was used to calculate a pre-treatment (Pretest) mean in both MRDR and Cognos. Data from the MRDR was reported separately from that of Cognos. 50 participants were used in the Research Study as the Experimental Group. 50 other participants were used in the Research Study as the Experimental Group. As a part of the Experimental Group, those participants were allowed to use Twitter for collaboration and problem solving in a manner described earlier using closed, anonymous and uniquely identified Twitter accounts whereas the Control Group worked with no changes in their daily routines but were allowed to use Twitter at their leisure. The data collection was automated and left in raw form. After approximately 3 months, the mean from the post-treatment (posttest) months was queried from the MRDR and Cognos systems and compared to the pre-treatment (pre-test) using Paired T Test for both groups. The same building, equipment, climate, supervision and management were used for both the Experimental and Control Groups. Data was collected simultaneously for both groups using the same automated system described previously. These factors allowed for the least amount of variability between the participants of the research study.

Research Study Data Analysis

Upon completion of a T-Test analysis involving both Research Questions, a comparison of the critical t-value and the calculated t-statistic was completed. If the calculated t-statistic was greater than the critical t-value, the test would have shown that there is a statistically significant difference between the two populations of data. In this case, the null hypothesis was rejected. If no statistically significant difference was found between the two populations of data, the test would have failed to reject the null hypothesis. Scores was reported in percentage gain of loss for either of the quality assurance metrics (in the form of internal and external rejection rates) in parts per million (PPM) and on time delivery % (OTD%). Improvement in quality performance as measured using PPM would see the PPM value reduce approaching a value of 0. A value of 0 PPM would indicate perfect quality performance. Improvement in delivery performance as measured using OTD% would see a value increase towards 100%. A value of 100% in OTD% would indicate a perfect delivery performance. In both instances, the Experimental Group saw a significant reduction in PPM and an increase in OTD% performance. In the Control Group, there was a negligible reduction in the PPM value and a nearly identical value for OTD% performance after treatment. (See table below)

Data Comparison after Treatment

	Change (Experimental)	Change (Control)	Ending Value (Control)	Ending Value (Experimental)
PPM MRDR	-226.11	-15.79	716.01	500.58
PPM Cognos	-219.17	-11.47	694.05	521.20
Delivery MRDR %	2.16	0.12	98.51	98.51
Delivery Cognos %	2.02	0.07	98.53	98.53

Table 5.3

Raw Data from MRDR and Cognos

Technical Center Experimental Employee Data

	PPM MRDR		PPM Cognos		Delivery MRDR		Delivery Cognos	
Employee ID	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean
1	899	683	986	749	97.3	97.2	94.5	98.8
2	950	722	830	631	97.4	99.0	96.8	97.2
3	961	730	821	624	95.0	99.8	96.4	98.8
4	815	619	827	629	95.2	99.2	97.6	98.2
5	960	730	860	654	96.2	99.7	95.8	99.3
6	907	689	1040	790	97.3	99.2	95.9	98.1
7	830	631	843	641	95.0	99.1	97.3	98.7
8	959	729	827	629	96.8	97.1	96.6	99.5
9	804	611	803	610	96.0	97.0	96.1	97.5
10	1078	819	1100	836	96.2	98.1	96.4	97.9
11	1015	771	944	717	98.0	99.6	97.8	97.0
12	911	692	812	617	96.4	98.8	97.1	97.8
13	1038	789	818	622	96.1	97.3	95.5	99.9
14	828	629	848	644	96.2	97.9	95.6	97.2
15	920	699	818	622	95.0	99.5	95.7	99.2
16	896	681	1048	796	96.7	97.4	96.0	97.9
17	1063	808	873	663	97.0	97.6	97.5	98.0
18	1071	814	887	674	97.6	97.8	97.9	98.6
19	969	736	815	619	95.8	98.4	95.3	98.3
20	1040	790	893	679	96.7	98.2	97.1	99.4
21	1027	781	1054	801	95.1	98.4	98.0	97.9
22	1041	791	1059	805	96.9	97.8	97.3	99.9
23	805	612	829	630	96.9	99.1	95.5	99.4
24	1026	780	814	619	95.1	99.0	97.7	98.3
25	1091	829	985	749	96.6	98.6	96.5	98.4
26	1089	828	869	660	97.0	98.6	97.3	99.8
27	1058	804	805	612	95.8	99.7	97.9	99.9
28	902	686	850	646	97.0	99.3	97.5	98.8
29	891	677	1002	762	97.4	99.2	96.2	99.3
30	856	651	932	708	95.8	99.5	95.2	98.8
31	856	651	1006	765	95.7	97.9	95.7	98.5
32	858	652	989	752	96.2	99.6	96.8	97.3
33	901	685	1017	773	96.4	99.2	96.5	98.6
34	858	652	1011	768	95.1	98.6	96.5	99.7
35	988	751	800	608	96.3	97.6	97.2	97.3
36	958	728	1064	809	96.5	99.6	97.2	99.0
37	818	622	851	647	95.3	98.0	95.4	97.7
38	870	661	852	648	97.0	99.1	96.4	97.8
39	830	631	1001	761	95.3	99.1	96.2	98.5
40	1028	781	815	619	97.8	98.7	96.3	98.4
41	1005	764	848	644	97.4	97.1	95.3	97.8
42	1007	765	982	746	97.0	99.6	96.4	98.8
43	963	732	967	735	95.3	98.7	97.8	99.0
44	853	648	811	616	95.5	98.7	97.9	97.8
45	855	650	1063	808	96.3	99.3	95.9	99.1
46	945	718	803	610	95.9	97.4	95.9	99.9
47	980	745	882	670	97.9	97.6	95.2	97.1
48	1008	766	1022	777	96.9	97.3	96.7	99.3
49	990	752	890	676	96.1	98.4	96.9	97.2
50	835	635	1095	832	95.9	97.3	95.3	100.0
SD	86.25	65.55	96.69	73.49	0.84	0.85	0.90	0.87
Mean	942.12	716.01	913.22	694.05	96.35	98.51	96.51	98.53
Cumulative	47106.00	35800.56	45661.00	34702.36	4817.30	4925.59	4825.56	4926.72

Table 5.4

Technical Center Control Employee Data

	PPM MRDR		PPM Cognos		Delivery MRDR		Delivery Cognos	
Employee ID	Pre Treatment Mean	Post Treatment	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean	Pre Treatment Mean	Post Treatment Mean
1	1144	1019	1005	972	95.1	95.7	95.8	94.5
2	999	1015	1160	1188	96.4	95.5	96.3	96.0
3	1089	1160	1174	1017	96.2	95.2	94.6	95.4
4	901	1179	976	1133	97.7	96.1	96.7	96.3
5	1026	930	997	995	95.3	96.5	94.0	95.7
6	922	1146	1131	1095	97.0	97.2	96.1	96.9
7	1148	1037	1167	1072	97.9	96.6	96.1	94.9
8	1120	933	959	1012	95.1	97.4	94.1	94.7
9	1121	1019	1061	984	95.7	97.4	95.9	96.6
10	1181	1168	1081	1052	95.2	97.2	94.5	94.1
11	1128	918	1200	1141	95.4	96.3	95.9	96.6
12	1082	1020	969	951	96.3	95.2	94.5	95.3
13	942	1055	1079	1179	96.1	97.6	95.1	95.8
14	905	966	1072	1133	97.6	95.2	95.6	96.3
15	1001	983	1082	1165	97.4	96.5	95.1	94.8
16	1042	979	1045	953	95.0	95.3	95.3	96.8
17	1102	965	971	1139	97.8	95.2	95.0	95.7
18	1125	901	1120	1076	97.5	96.3	95.7	95.0
19	1019	1120	1151	1060	97.6	95.7	95.7	94.2
20	1089	1064	981	1138	95.3	96.0	95.5	96.8
21	1048	953	1001	1178	96.0	97.3	95.6	95.6
22	977	949	1133	1119	97.6	96.2	95.7	97.0
23	1139	1197	1160	1129	97.5	97.3	95.3	94.6
24	1050	1128	1085	1081	95.4	97.1	96.6	96.7
25	933	921	1200	1067	96.0	97.6	95.3	94.6
26	1003	987	1122	1001	95.4	96.8	94.5	96.6
27	1103	1031	1096	1157	96.0	95.5	94.2	95.5
28	1107	916	1077	1196	97.7	96.0	94.9	94.4
29	1093	1101	1148	1040	95.2	97.2	96.7	96.9
30	1065	1005	1041	1116	96.5	95.3	96.3	96.9
31	1044	1081	1165	974	97.2	97.0	95.6	95.6
32	1181	1049	1086	1155	96.1	97.9	94.6	95.2
33	901	1047	1172	1033	96.2	95.6	96.9	95.0
34	924	1048	1132	1023	95.8	95.5	96.7	96.8
35	984	1176	1030	971	96.6	96.6	94.1	94.9
36	1083	1139	1055	1061	97.5	96.9	94.3	96.9
37	998	907	1102	1159	96.6	96.4	94.0	96.2
38	967	1033	1067	990	96.1	96.7	94.0	96.1
39	908	1080	1129	1054	95.5	96.4	94.6	96.0
40	1046	933	973	1189	97.0	95.7	96.0	95.5
41	1020	1113	997	1032	96.1	97.7	95.1	94.3
42	1023	1153	1011	1062	97.2	95.9	95.8	94.8
43	1013	1049	1091	1123	96.9	97.2	97.0	94.9
44	1111	1114	1157	1151	96.2	98.0	95.1	94.5
45	991	1032	1022	1120	95.1	97.1	95.0	96.5
46	1186	1130	1095	1053	95.2	97.7	94.2	95.7
47	1120	1066	1148	1108	97.1	96.7	97.0	96.7
48	961	1052	1010	1103	96.1	97.1	95.9	94.1
49	1035	1043	1069	1077	95.6	96.9	96.9	94.9
50	1012	1007	974	996	96.6	95.2	94.5	94.9
SD	79.52	81.64	69.44	69.94	0.90	0.83	0.90	0.92
Mean	1042.24	1040.34	1078.58	1079.46	96.35	96.49	95.40	95.61
Cumulative	52112.00	52017.00	53929.00	53973.00	4817.57	4824.60	4770.13	4780.71

Table 5.5

Results of Research Study

Experimental Group Data

PPM is reported in actual values where quality performance is measured in Parts per Million (PPM). The lower the PPM value, the better quality performance is being executed.

Results from data analysis of Experimental Group using Paired T- Test follows:

Data: PPM MRDR

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest PPM MRDR minus posttest PPM MRDR equals 226.12

95% confidence interval of this difference: From 195.72 to 256.52

Intermediate values used in calculations:

t = 14.7625

df = 98

standard error of difference = 15.317

Group	Pretest PPM MRDR	Posttest PPM MRDR
Mean	942.12	716.00
SD	86.25	65.51
SEM	12.20	9.26
N	50	50

Data: PPM Cognos

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest PPM Cognos minus posttest PPM Cognos equals 219.18

95% confidence interval of this difference: From 185.09 to 253.27

Intermediate values used in calculations:

t = 12.7605

df = 98

standard error of difference = 17.176

Group	Pretest PPM Cognos	Posttest PPM Cognos
Mean	913.22	694.04
SD	96.69	73.50
SEM	13.67	10.39
N	50	50

Data: Delivery MRDR

On Time Delivery (OTD%) is reported in percentages. The higher the OTD% value, the better quality performance is being executed.

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus posttest Delivery MRDR equals -2.172

95% confidence interval of this difference: From -2.544 to -1.800

Intermediate values used in calculations:

t = 11.7455

df = 49

standard error of difference = 0.185

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	96.346	98.518
SD	0.846	0.858
SEM	0.120	0.121
N	50	50

Data: Delivery Cognos

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus posttest Delivery MRDR equals -2.022

95% confidence interval of this difference: From -2.389 to -1.655

Intermediate values used in calculations:

t = 11.0791

df = 49

standard error of difference = 0.183

Group	Pretest Delivery Cognos	Posttest Delivery Cognos
Mean	96.510	98.532
SD	0.897	0.869
SEM	0.127	0.123
N	50	50

Control Group Data

PPM is reported in actual values where quality performance is measured in Parts Per Million (PPM). The lower the PPM value, the better quality performance is being executed.

Data: PPM MRDR

P value and statistical significance:

The two-tailed P value equals 0.9056

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest PPM MRDR minus Posttest PPM MRDR equals 1.90

95% confidence interval of this difference: From -30.12 to 33.92

Intermediate values used in calculations:

t = 0.1192

df = 49

standard error of difference = 15.936

Group	Pretest PPM MRDR	Posttest PPM MRDR
Mean	1042.24	1040.34
SD	79.52	81.64
SEM	11.25	11.55
N	50	50

Data: PPM Cognos

P value and statistical significance:

The two-tailed P value equals 0.9474

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest PPM Cognos minus Posttest PPM Cognos equals -0.88
95% confidence interval of this difference: From -27.55 to 25.79

Intermediate values used in calculations:

t = 0.0663
df = 49
standard error of difference = 13.271

Group	Pretest PPM Cognos	Posttest PPM Cognos
Mean	1078.58	1079.46
SD	69.44	69.94
SEM	9.82	9.89
N	50	50

Data: Delivery MRDR

On Time Delivery (OTD%) is reported in percentages. The higher the OTD% value, the better quality performance is being executed.

P value and statistical significance:

The two-tailed P value equals 0.4726
By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus Posttest Delivery MRDR equals -0.140
95% confidence interval of this difference: From -0.529 to 0.249

Intermediate values used in calculations:

t = 0.7239
df = 49
standard error of difference = 0.193

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	96.352	96.492
SD	0.897	0.839
SEM	0.127	0.119
N	50	50

Data: Delivery Cognos

P value and statistical significance:

The two-tailed P value equals 0.1952

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Pretest Delivery MRDR minus Posttest Delivery MRDR equals -0.216

95% confidence interval of this difference: From -0.546 to 0.114

Intermediate values used in calculations:

t = 1.3134

df = 49

standard error of difference = 0.164

Group	Pretest Delivery MRDR	Posttest Delivery MRDR
Mean	95.398	95.614
SD	0.904	0.913
SEM	0.128	0.129
N	50	50

Intervention Fidelity

Throughout the study, it appeared that the participants were able to use Twitter in the way that the experiment was designed and without discontinuance in availability. In this case, it appears that the intervention was delivered as intended leading to a complete and undisrupted study.

Conclusions

The mean values of the quality and delivery means for the research study for both the Experimental and Control Groups were very similar yet the results after treatment would show significant differences between the two groups. The results of the T Test show that the Experimental Group experienced a statistically significant change between the Pretest and Posttest of this study rejecting the null hypothesis. At the same time, the data from the Control Group during the same period shows that the null hypothesis could not be rejected. This indicates that there was no statistical difference in results between Pretest and Posttest indicating that the intervention of social media for learning was effective for an improvement in both quality and delivery metrics involving the Experimental Group. Below is a table of the commonly accepted P-Values and how they correspond to whether there is a statistically significant difference in pretest and posttest data:

$P > 0.10$ No evidence against the null hypothesis. The data appear to be consistent with the null hypothesis.
$0.05 < P < 0.10$ Weak evidence against the null hypothesis in favor of the alternative.
$0.01 < P < 0.05$ Moderate evidence against the null hypothesis in favor of the alternative.
$0.001 < P < 0.01$ Strong evidence against the null hypothesis in favor of the alternative.
$P < 0.001$ Very strong evidence against the null hypothesis in favor of the alternative.

Table 5.6

As the results indicate, the Experimental Group data shows all results for P-Value are <0.0001 indicating very strong evidence against the null hypothesis in favor of the alternative. The Control Group data showed a P-Value range from 0.1952-0.9474, clearly indicating that there is no evidence against the null hypothesis.

The graph below shows the difference between the Experimental and Control Groups in regard to the effect of the treatment on quality performance. Quality performance is typically reported in terms of Parts per Million (PPM). The Experimental Group saw an average reduction of 441.58 PPM reported through the MRDR system and a 392.02 PPM reduction reported through the Cognos system. The Control Group saw an average increase of 3.12 PPM reported through the MRDR system and a 0.50 PPM reduction reported through the Cognos system.

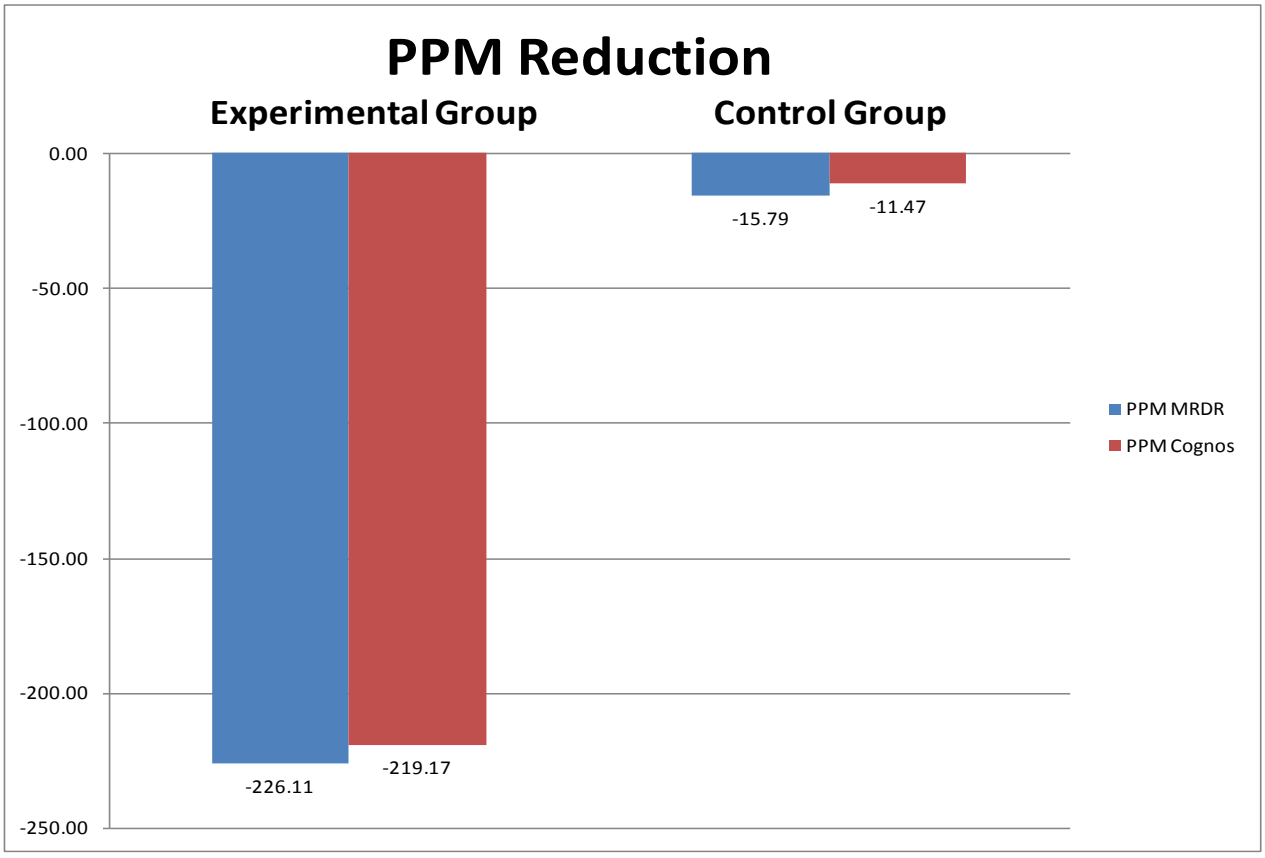


Figure 5.2

The graph below shows the difference between the Experimental and Control Groups in regard to the effect of the treatment on delivery performance. Delivery performance is typically reported in terms of on time delivery percentage (OTD%). The higher a value for OTD%, the higher the delivery performance is. The goal for any workplace is to reach a 100% OTD%. The following graph shows the effect of the treatment in the change of delivery from Pretest conditions to Posttest conditions. Although both groups experienced an increase in OTD% in that period, the Experimental Group saw an average increase of 2.16% reported through the MRDR system and a 2.02% reduction reported through the Cognos system. In the same period, the Control Group saw an average increase of 0.14% reported through the MRDR system and a 0.43% increase reported through the Cognos system. The results show that while the Experimental Group saw an increase in the delivery performance as reported by both data collection systems, the Control Group experience a negligible amount of improvement.

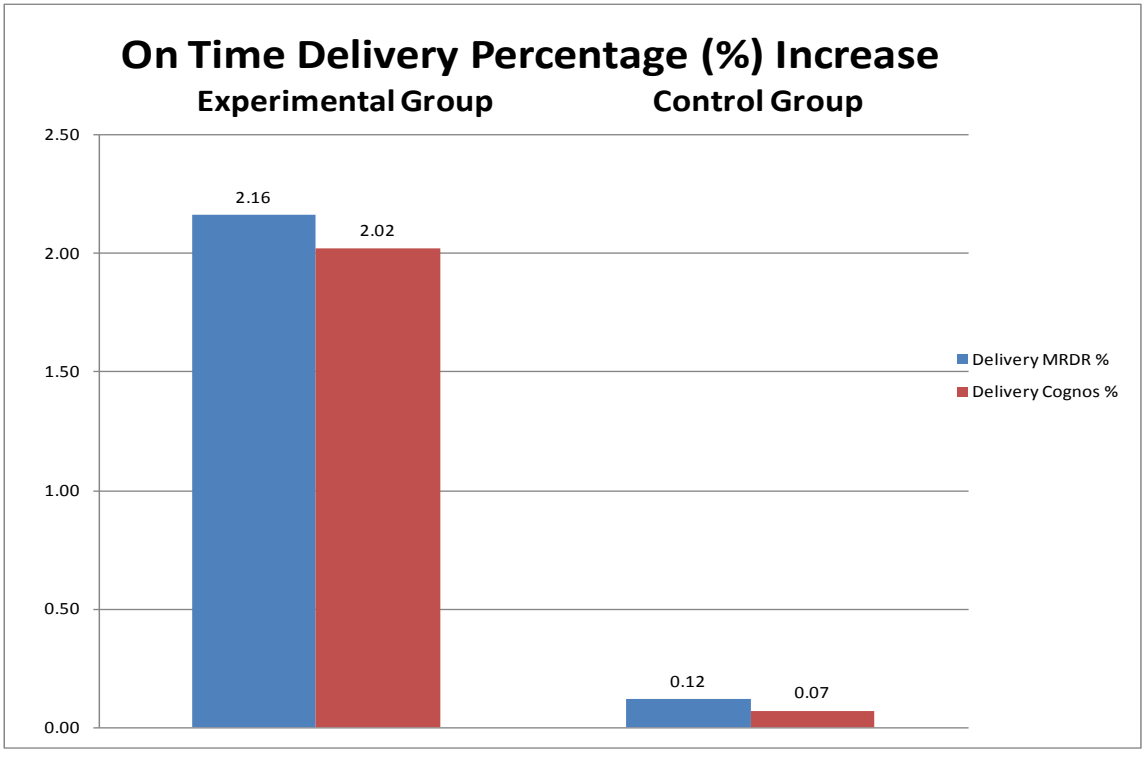


Figure 5.3

Triangulation

Data Source Triangulation provided evidence from more than one source. Data in the MRDR system is provided from a number of sources including incoming inspection, logistics, and the Global Purchasing Division. The MRDR system is used as a device to report to suppliers about quality and delivery performance. The Cognos system is a real time system that is linked to the organization-wide scheduling system that is constantly updating to inform team members of any manufacturing line delivery disruptions caused by delivery or quality situations. This data is uploaded from manufacturing line employees.

Adverse Events

This research study had no adverse events that had any bearing on the results. This study was completed over the period of approximately 90 days and all participants were able to work, without any absence, during this time period and had adequate connectivity and availability to Twitter in their workcenters.

Survey Data

The following data was collected from the online, anonymous survey that was hosted by SurveyMonkey. The Survey comprised of eight Likert scale questions (5 point scale from Strongly Disagree to Strongly Agree) and 5 open ended questions. Of the 50 members of the Experimental Group, only 48 completed the survey. To analyze the data from the Likert scale section of the online anonymous survey, the use of an analyze function in SurveyMonkey. The use of nVivo software was used to analyze the open ended questions using qualitative analysis. The results are shown below:

Likert Scale Questions

Question 1

Social Media in Manufacturing Workplace Survey

The Use of Twitter helped me complete my job on schedule

Answer Choices	Responses	
Strongly Disagree	4.17%	2
Disagree	16.67%	8
Neutral	45.83%	22
Agree	29.17%	14
Strongly Agree	4.17%	2
	Answered	**48**
	Skipped	**0**

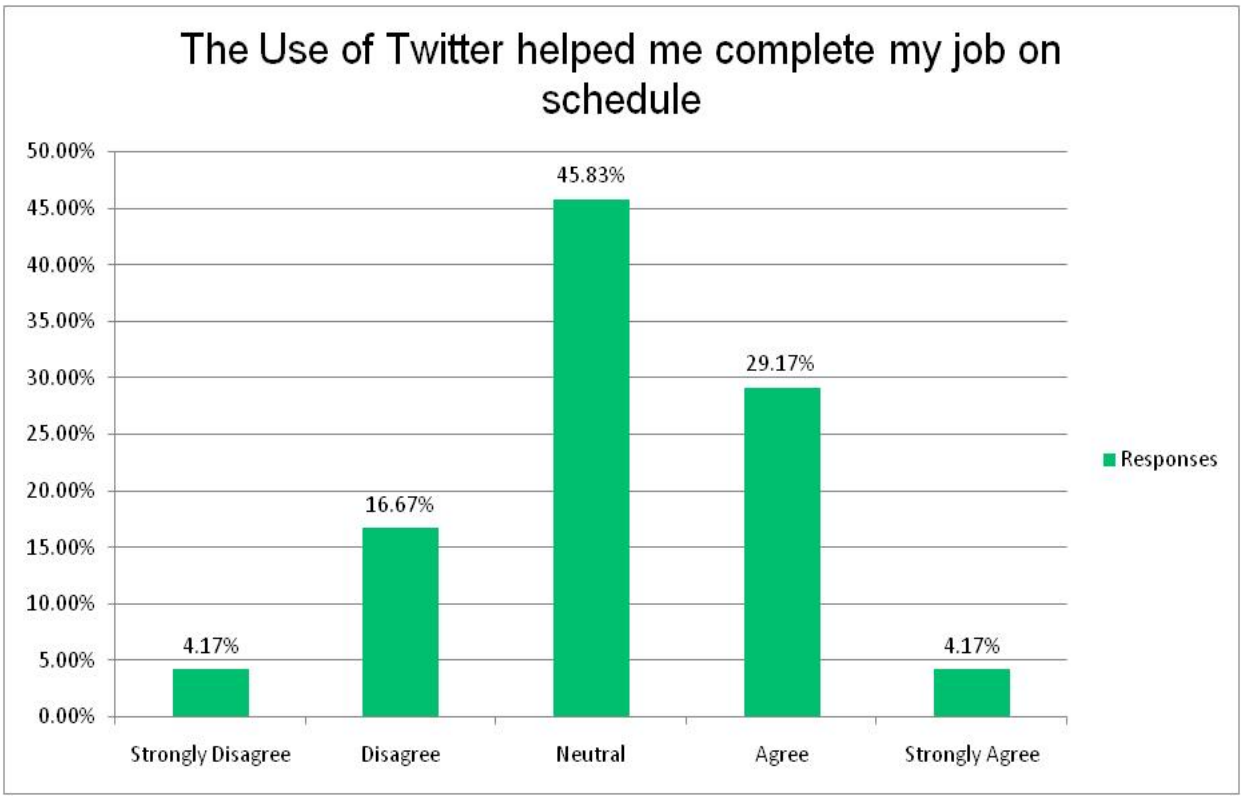


Figure 5.4

Question 2

Social Media in Manufacturing Workplace Survey

The Use of Twitter helped me complete my job with fewer errors

Answer Choices	Responses	
Strongly Disagree	0.00%	0
Disagree	6.25%	3
Neutral	20.83%	10
Agree	58.33%	28
Strongly Agree	14.58%	7
	Answered	**48**
	Skipped	**0**

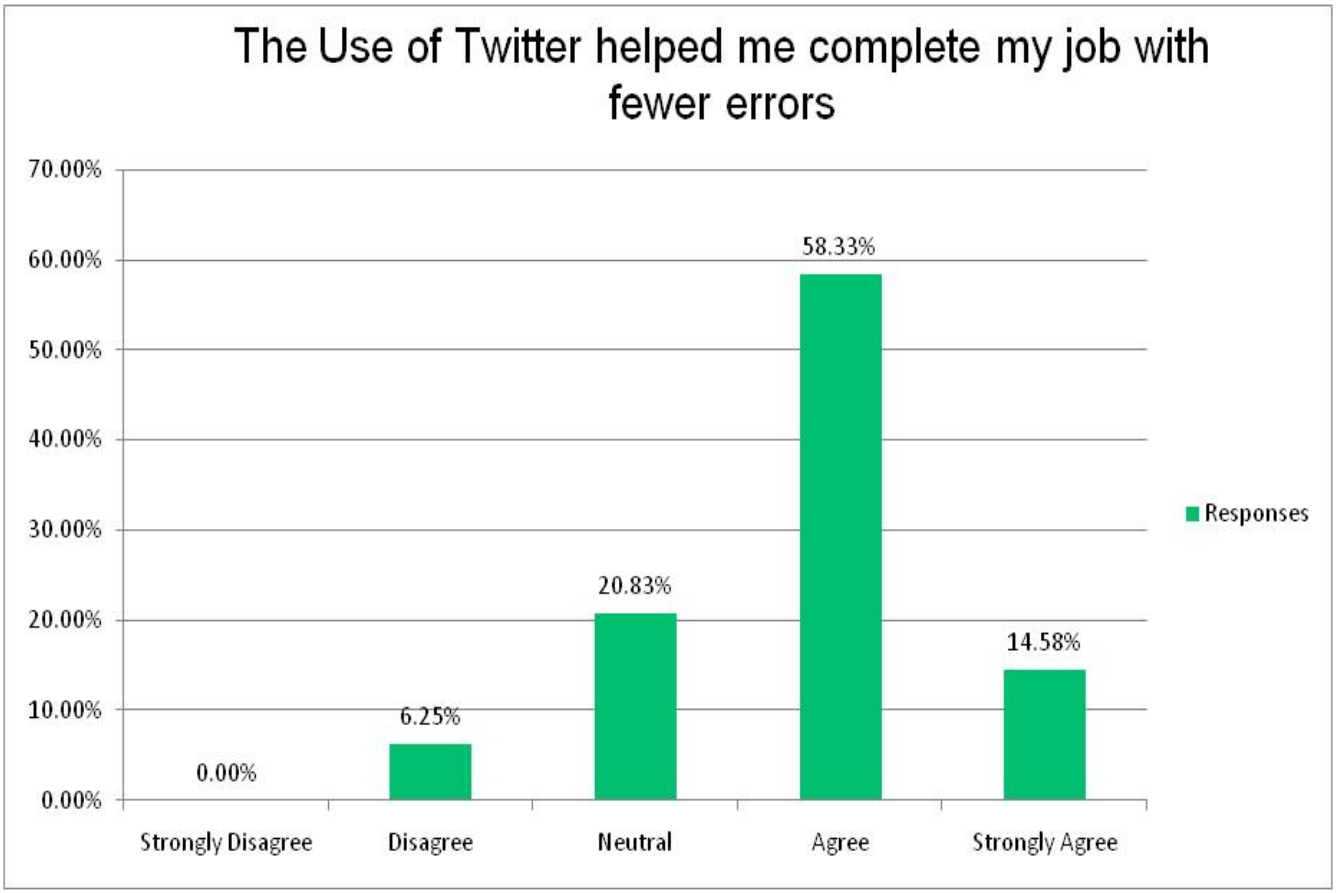


Figure 5.5

Question 3

Social Media in Manufacturing Workplace Survey

The Use of Twitter caused distractions in my daily work routine

Answer Choices	Responses	
Strongly Disagree	4.17%	2
Disagree	14.58%	7
Neutral	37.50%	18
Agree	18.75%	9
Strongly Agree	4.17%	2
	Answered	**48**
	Skipped	**0**

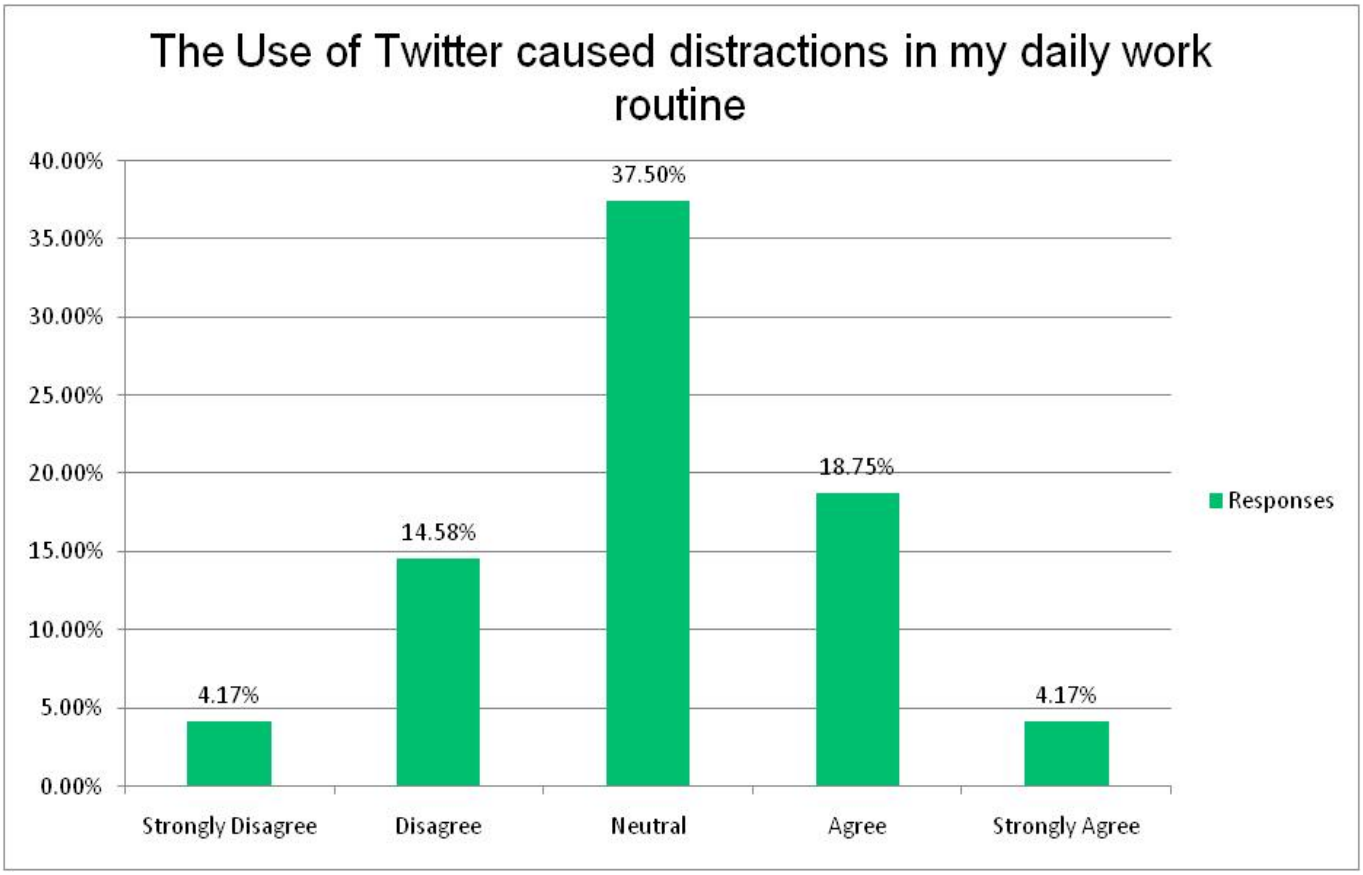


Figure 5.6

Question 4

Social Media in Manufacturing Workplace Survey

The Use of Twitter was valuable for completing my job requirements

Answer Choices	Responses	
Strongly Disagree	0.00%	0
Disagree	6.25%	3
Neutral	25.00%	12
Agree	47.92%	23
Strongly Agree	16.67%	8
	Answered	**48**
	Skipped	**0**

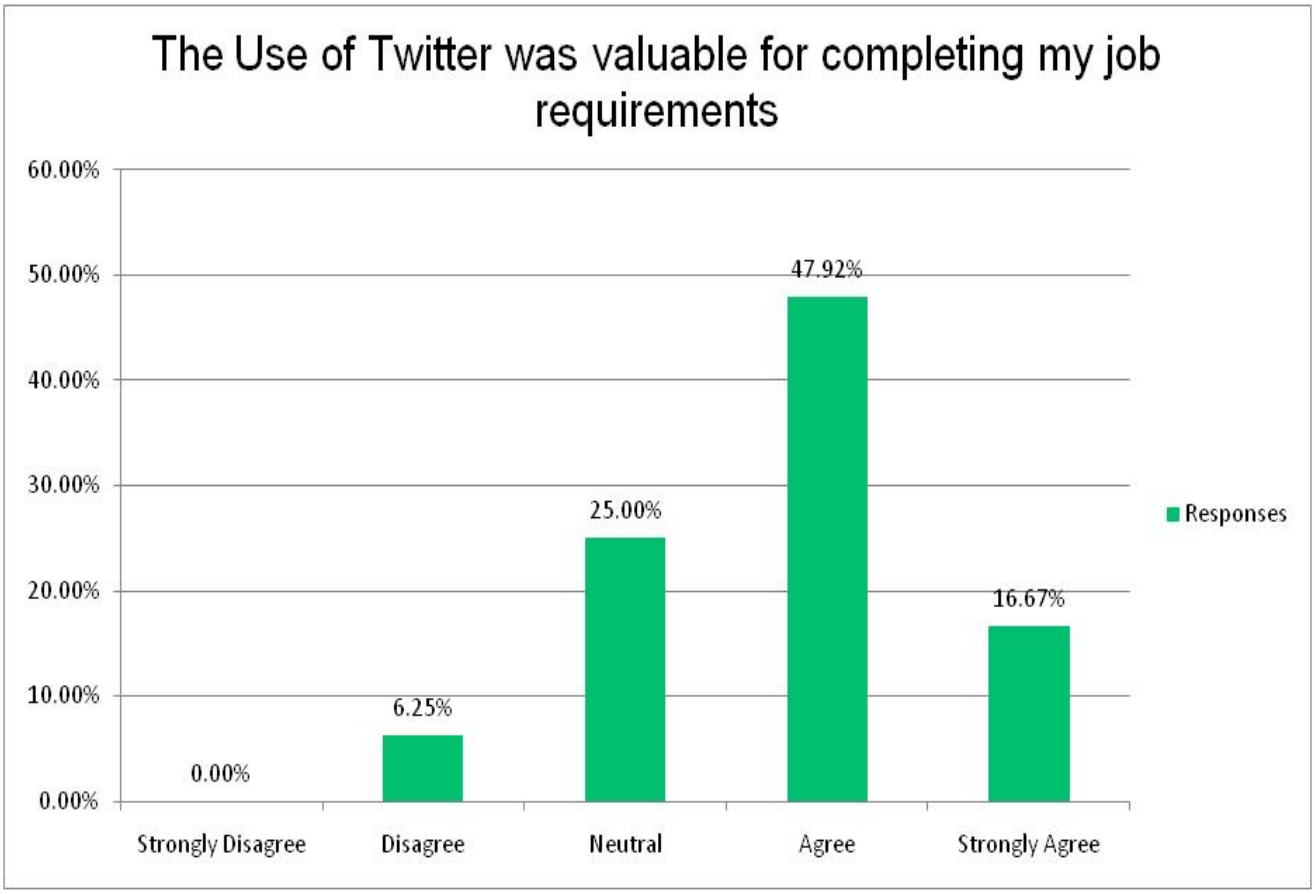


Figure 5.7

Question 5

Social Media in Manufacturing Workplace Survey

The Use of Twitter has made me more competent in my job performance

Answer Choices	Responses	
Strongly Disagree	0.00%	0
Disagree	0.00%	0
Neutral	39.58%	19
Agree	43.75%	21
Strongly Agree	16.67%	8
	Answered	**48**
	Skipped	**0**

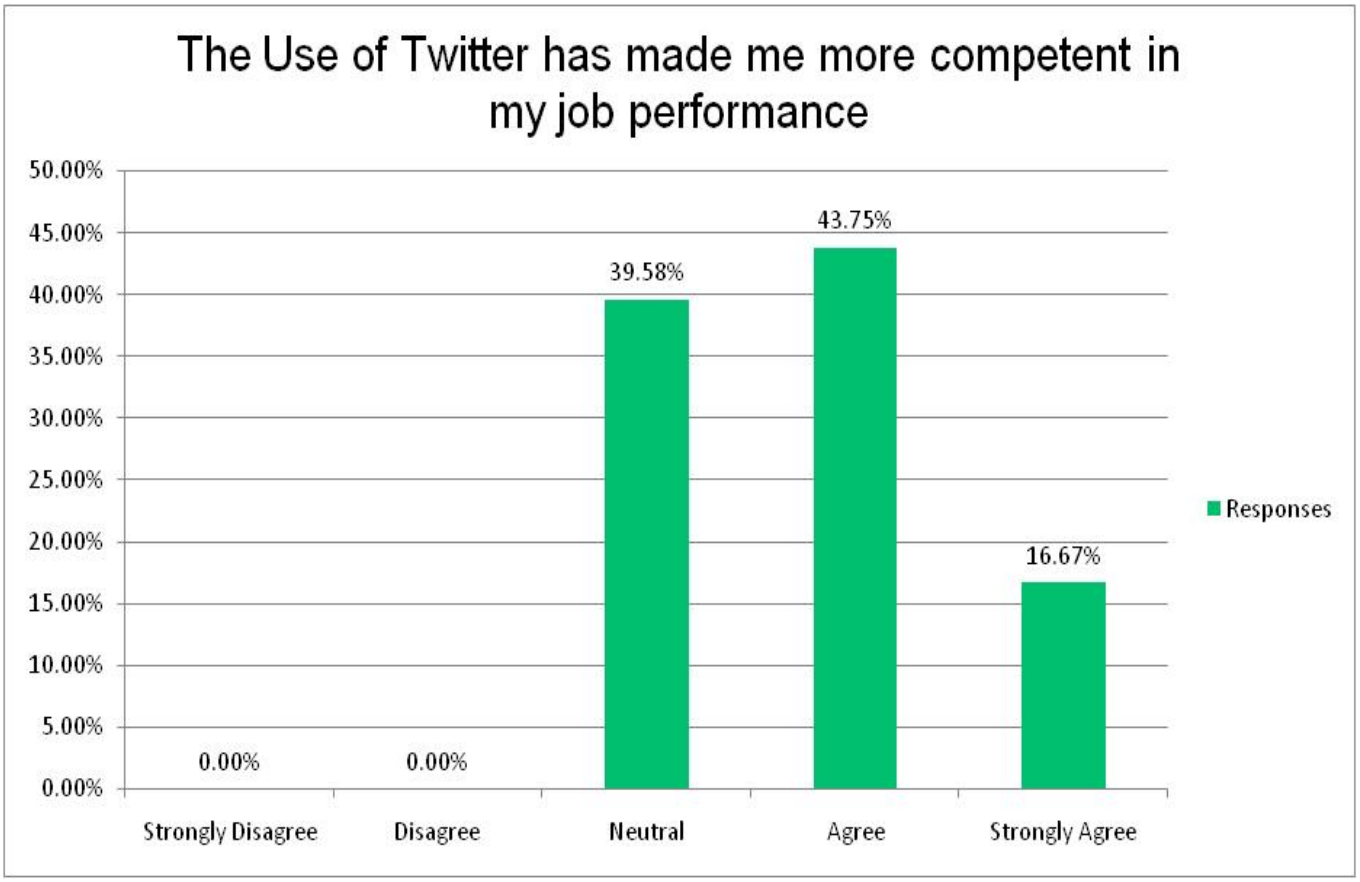


Figure 5.8

Question 6

Social Media in Manufacturing Workplace Survey

The Use of Twitter showed me that the company wants to help me become better at my job

Answer Choices	Responses	
Strongly Disagree	2.08%	1
Disagree	10.42%	5
Neutral	50.00%	24
Agree	33.33%	16
Strongly Agree	4.17%	2
	Answered	**48**
	Skipped	**0**

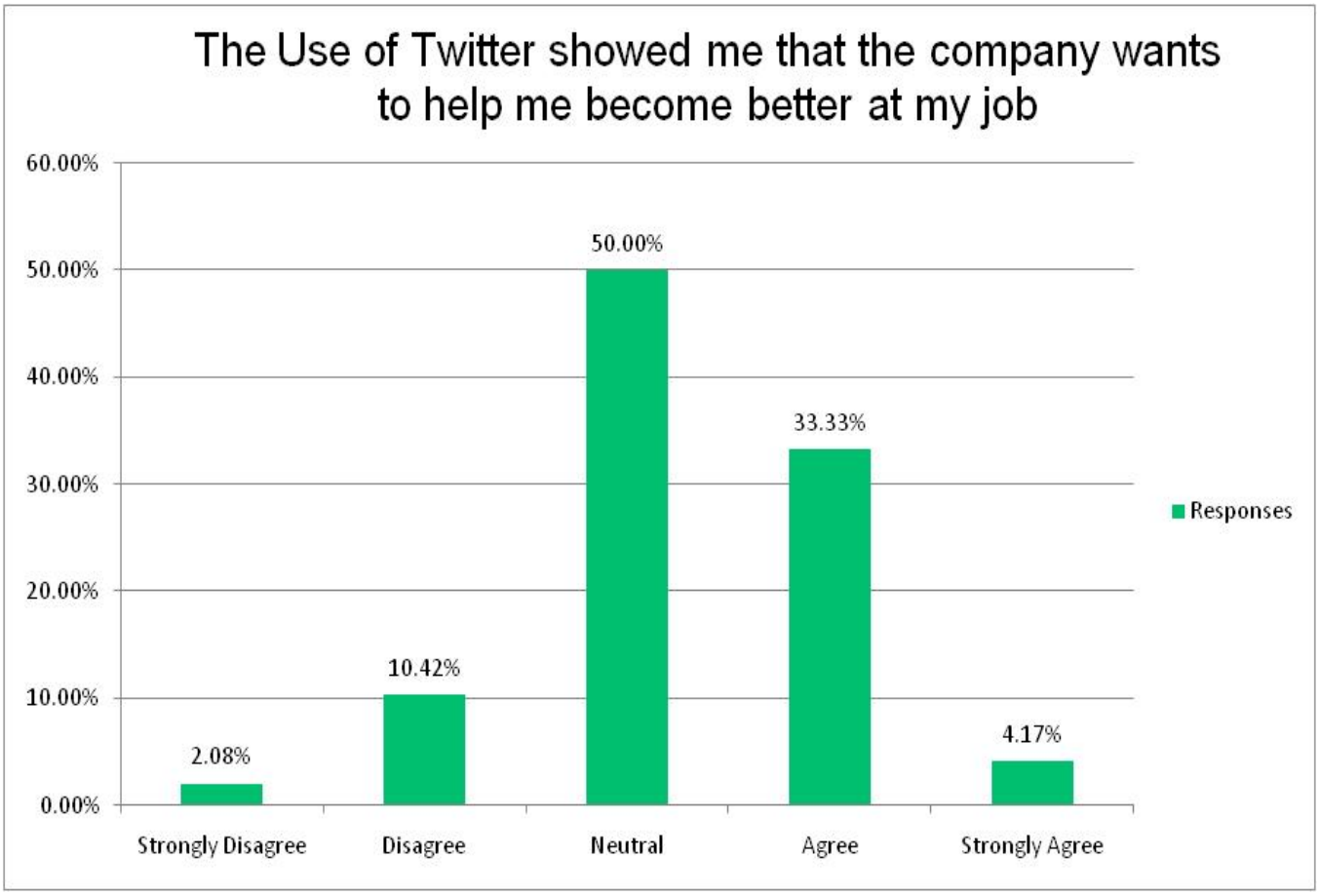


Figure 5.9

Question 7

Social Media in Manufacturing Workplace Survey

If Twitter is allowed to be used after this study, I am very likely to use it for daily work requirements

Answer Choices	Responses	
Strongly Disagree	6.25%	3
Disagree	10.42%	5
Neutral	52.08%	25
Agree	31.25%	15
Strongly Agree	0.00%	0
	Answered	**48**
	Skipped	**0**

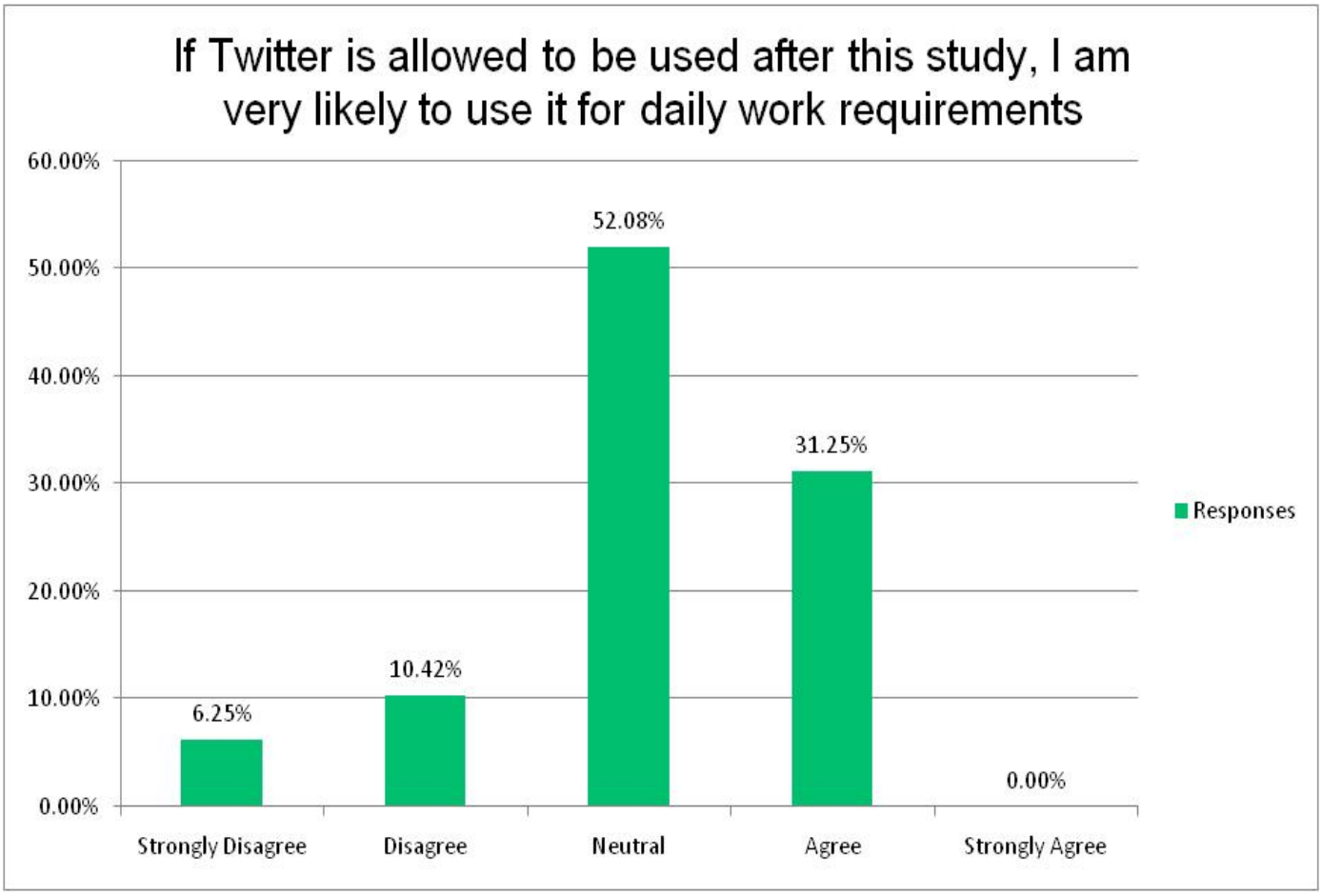


Figure 5.10

Question 8

Social Media in Manufacturing Workplace Survey

Before this study, how often did you use Twitter?

Answer Choices	Responses	
Never	16.67%	8
Only on weekends	2.08%	1
Occasionally on a weekday	2.08%	1
Daily	54.17%	26
All of the Time	25.00%	12
	Answered	**48**
	Skipped	**0**

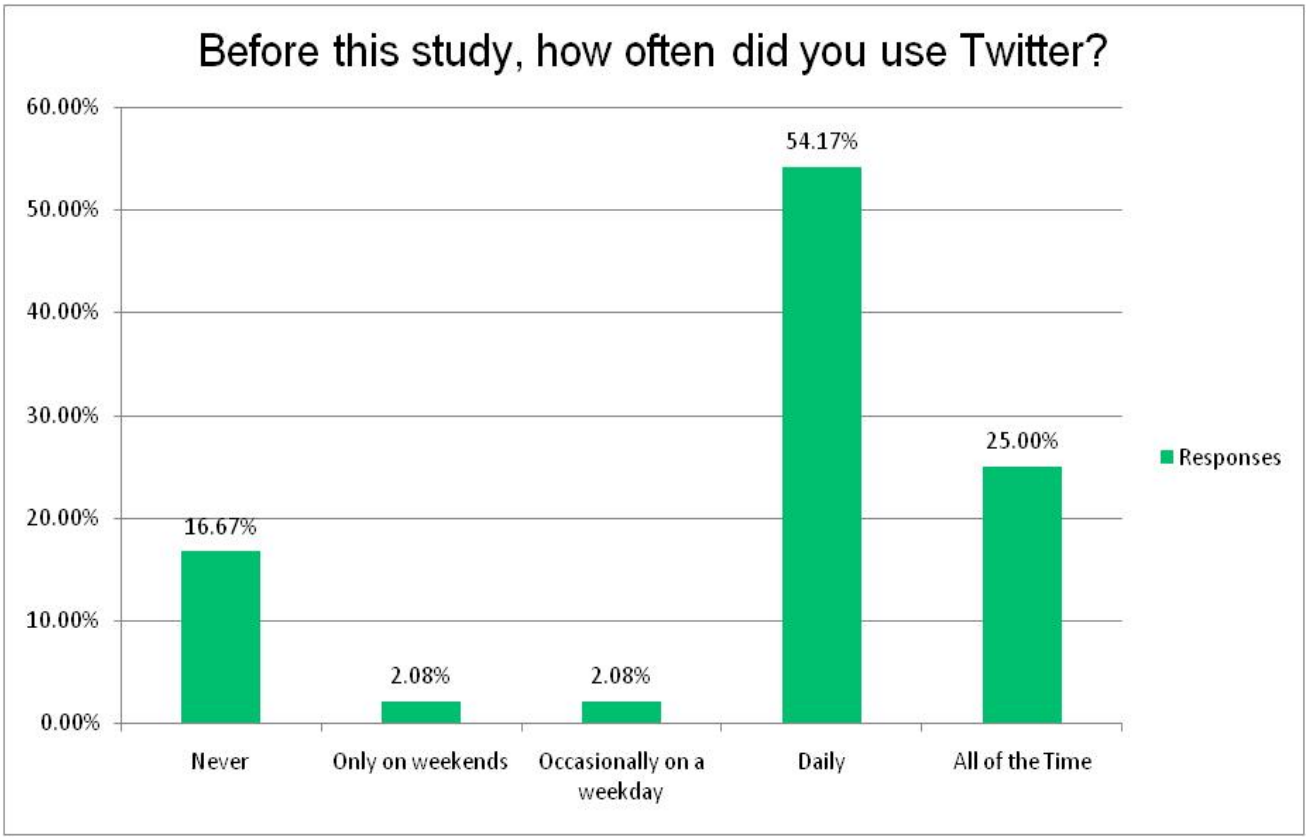


Figure 5.11

Open Ended Questions

Raw data is included in “Open Ended Question Data” (APPENDIX H)

Open Ended Question 1 (Question 9 of survey)

QUESTION: What did you like most about the use of Twitter for use in the workplace?

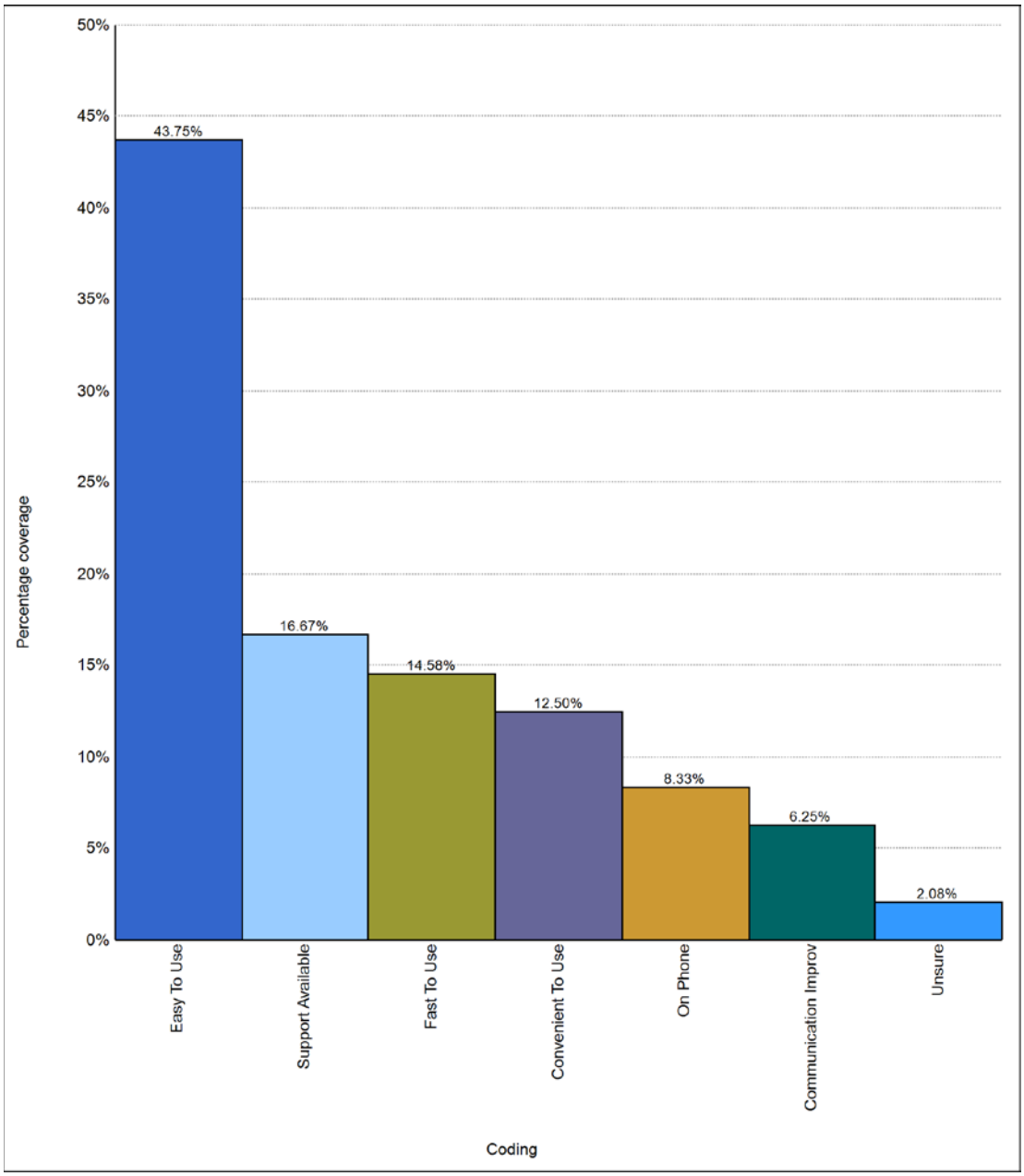


Figure 5.12

Open Ended Question 2 (Question 10 of survey)

QUESTION: What did you like least about the use of Twitter for use in the workplace?

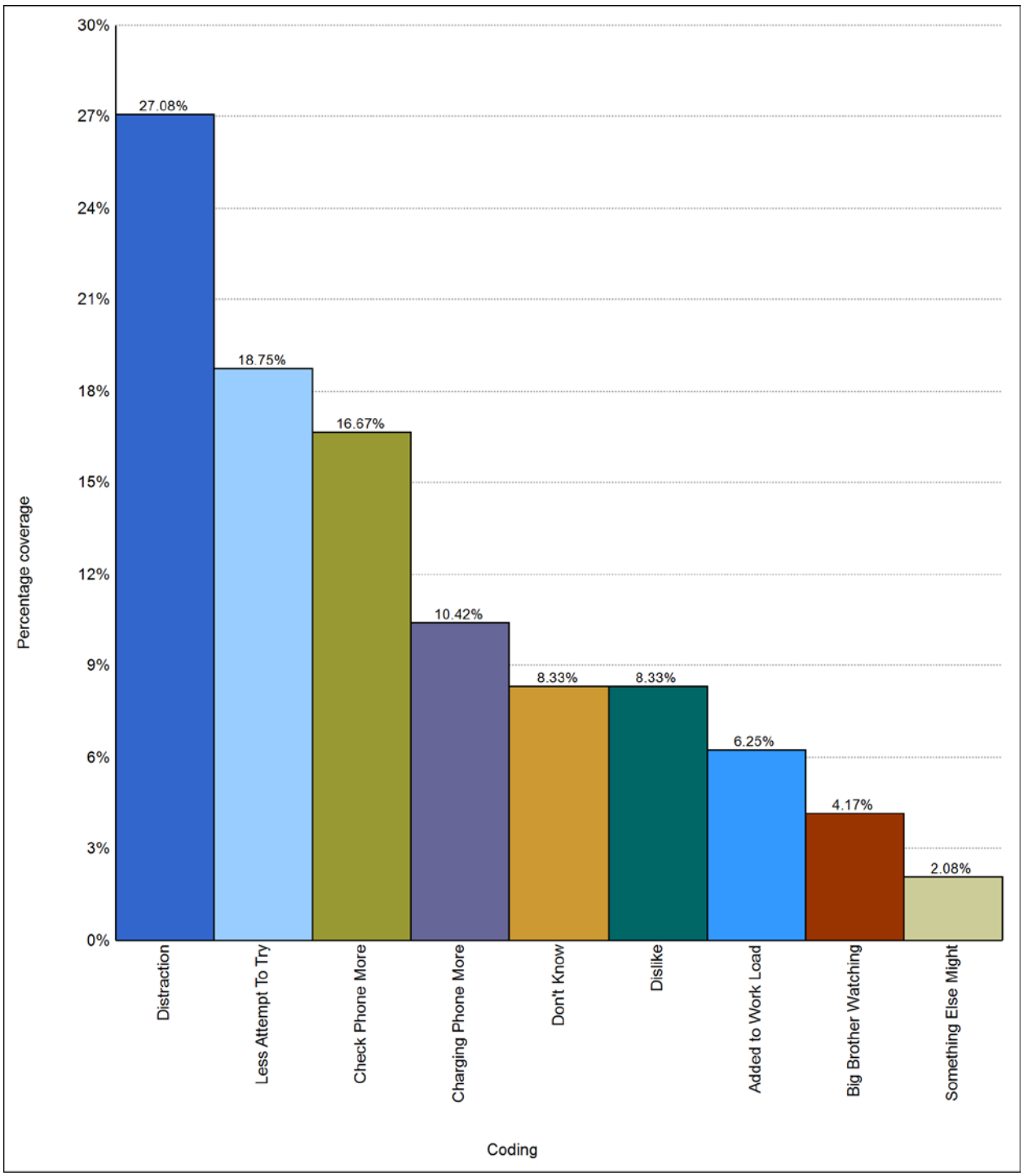


Figure 5.13

Open Ended Question 3 (Question 11 of survey)

QUESTION: How did you change the way you work as a result of the use of Twitter in the workplace?

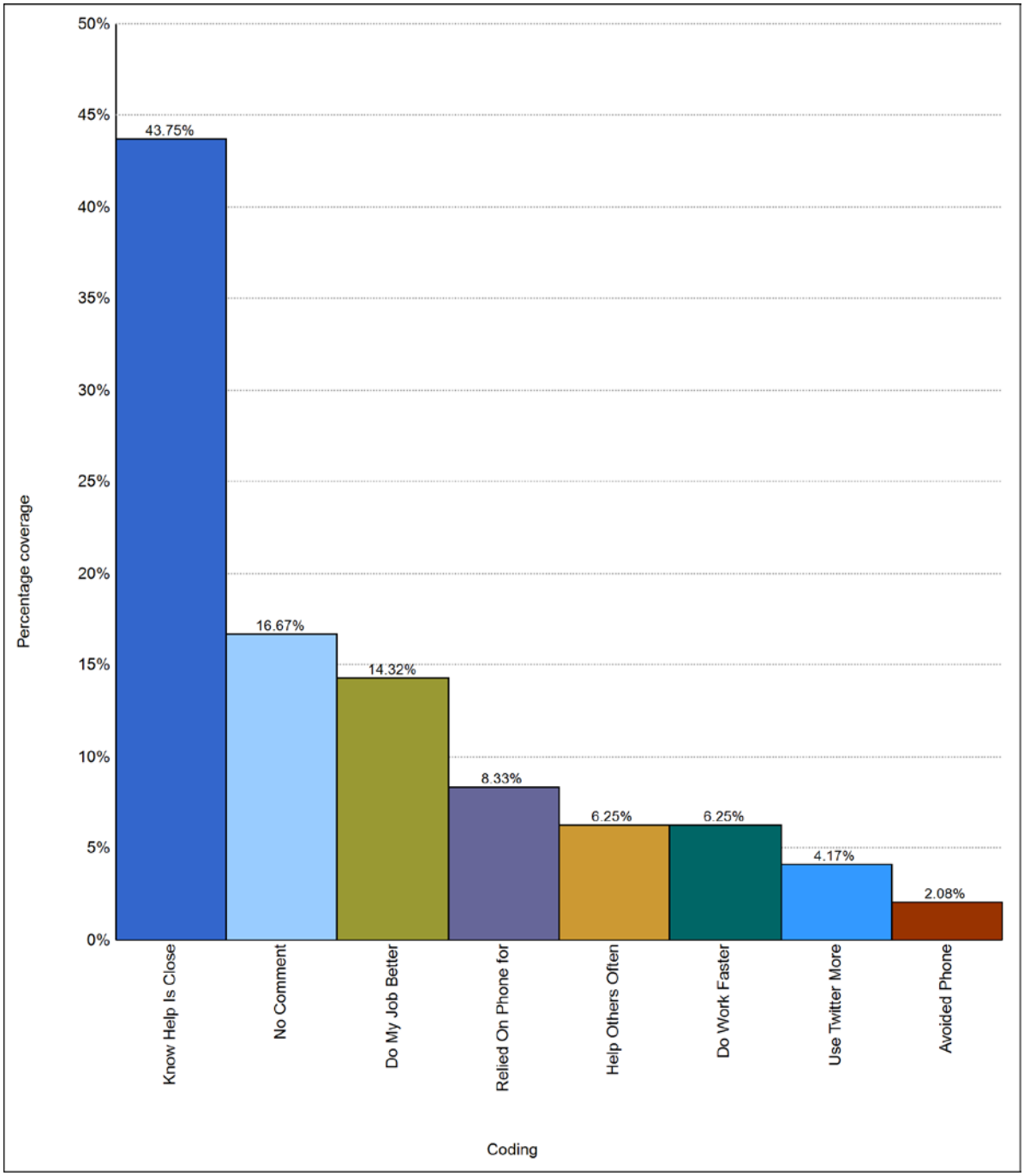


Figure 5.14

Open Ended Question 4 (Question 12 of survey)

QUESTION: Explain, in detail, how Twitter affected how you completed your job requirements.

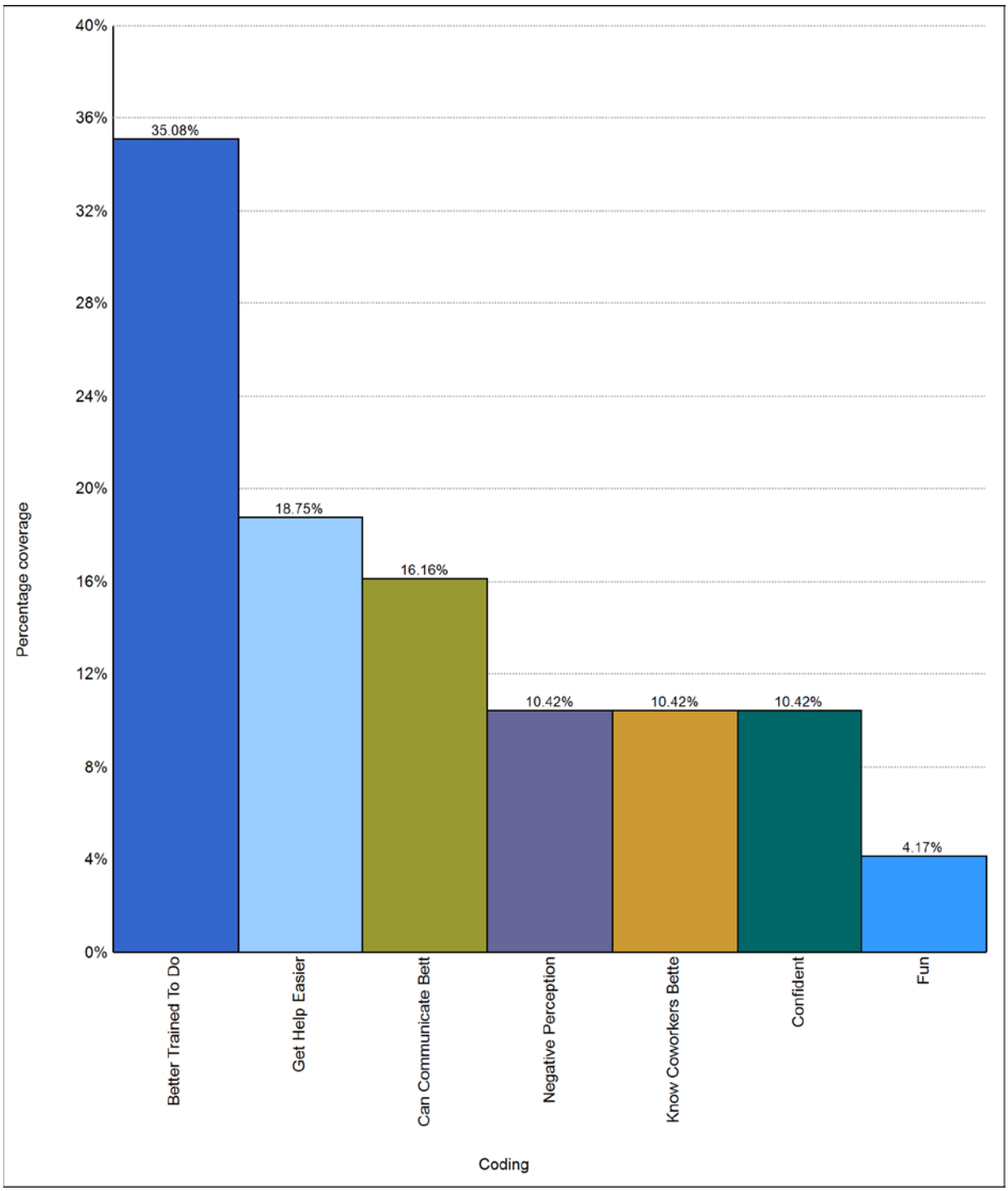


Figure 5.15

Open Ended Question 5 (Question 13 of survey)

QUESTION: Please share any other comments about the use of Twitter in the workplace.

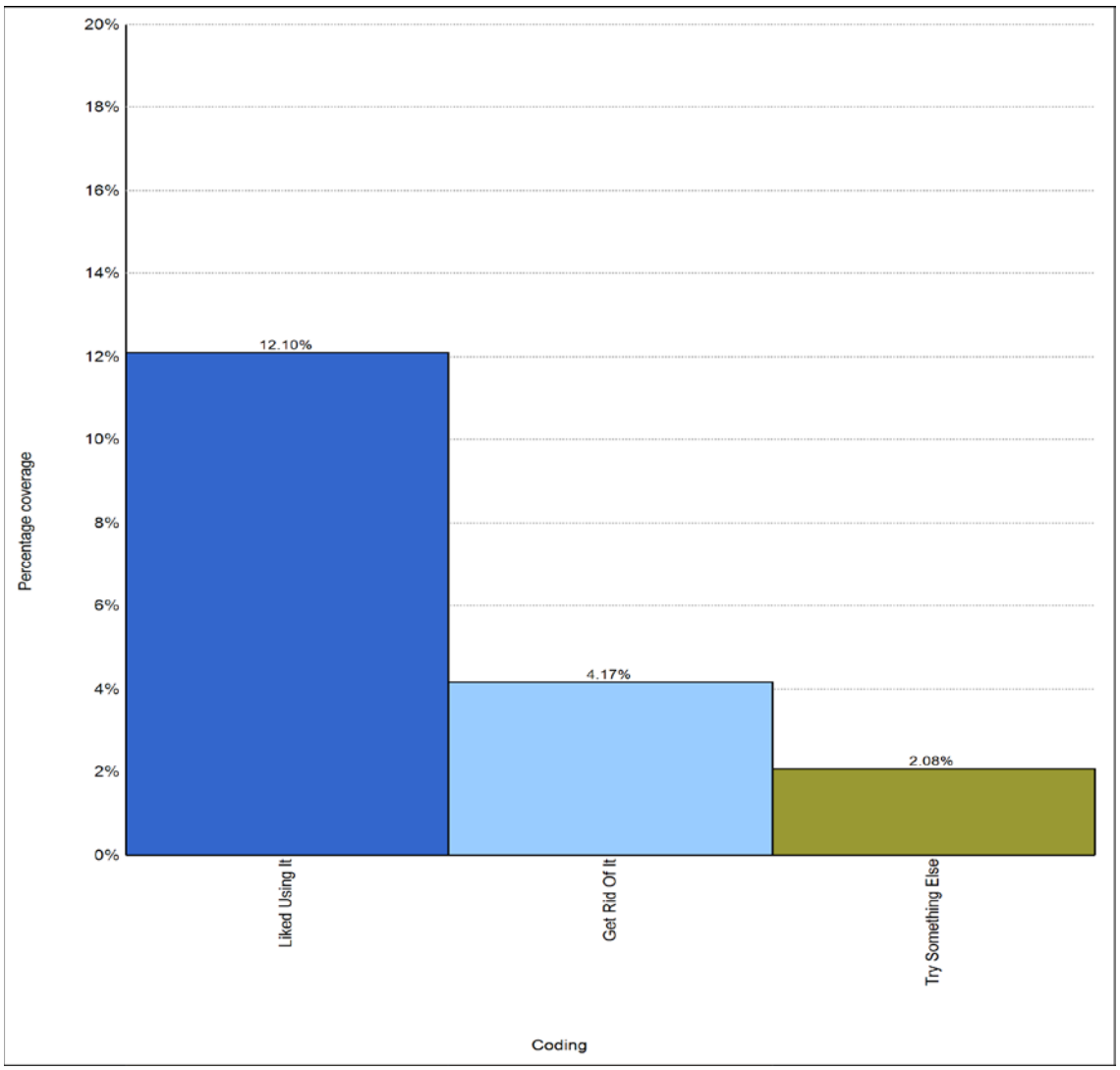


Figure 5.16

Twitter Analytics

The use of the Twitter Analytics application was employed to provide a deeper view into the activity of the research participants. The first table shows the usage of Twitter by each of the research participants using their assigned User IDs in each month of the study.

User ID	May 21-June 17	June 18-July 15	July 16-August 12	Total	Average Tweets per day(60 Working Days)
TCLResearch1	29	20	23	72	1.20
TCLResearch2	20	24	19	63	1.05
TCLResearch3	14	7	10	31	0.52
TCLResearch4	24	23	12	59	0.98
TCLResearch5	2	1	1	4	0.07
TCLResearch6	4	19	26	49	0.82
TCLResearch7	18	73	36	127	2.12
TCLResearch8	29	19	50	98	1.63
TCLResearch9	20	16	4	40	0.67
TCLResearch10	19	22	10	51	0.85
TCLResearch11	40	31	16	87	1.45
TCLResearch12	5	8	7	20	0.33
TCLResearch13	10	12	14	36	0.60
TCLResearch14	21	19	18	58	0.97
TCLResearch15	0	0	0	0	0.00
TCLResearch16	22	24	29	75	1.25
TCLResearch17	41	34	29	104	1.73
TCLResearch18	31	32	29	92	1.53
TCLResearch19	22	23	28	73	1.22
TCLResearch20	36	38	29	103	1.72
TCLResearch21	2	0	0	2	0.03
TCLResearch22	12	14	9	35	0.58
TCLResearch23	22	19	10	51	0.85
TCLResearch24	2	2	1	5	0.08
TCLResearch25	31	26	19	76	1.27
TCLResearch26	24	20	10	54	0.90
TCLResearch27	12	14	11	37	0.62
TCLResearch28	29	21	14	64	1.07
TCLResearch29	23	20	7	50	0.83
TCLResearch30	29	18	6	53	0.88
TCLResearch31	12	25	29	66	1.10
TCLResearch32	4	3	5	12	0.20
TCLResearch33	16	14	10	40	0.67
TCLResearch34	61	40	22	123	2.05
TCLResearch35	2	3	2	7	0.12
TCLResearch36	33	19	18	70	1.17
TCLResearch37	45	52	32	129	2.15
TCLResearch38	4	5	3	12	0.20
TCLResearch39	17	21	9	47	0.78
TCLResearch40	19	13	2	34	0.57
TCLResearch41	22	16	11	49	0.82
TCLResearch42	29	24	24	77	1.28
TCLResearch43	20	19	14	53	0.88
TCLResearch44	85	108	81	274	4.57
TCLResearch45	44	36	20	100	1.67
TCLResearch46	10	11	9	30	0.50
TCLResearch47	37	24	10	71	1.18
TCLResearch47	94	121	87	302	5.03
TCLResearch49	41	32	31	104	1.73
TCLResearch50	20	14	14	48	0.80
Total	**1208**	**1199**	**910**	**3317**	**55.28**

Table 5.7

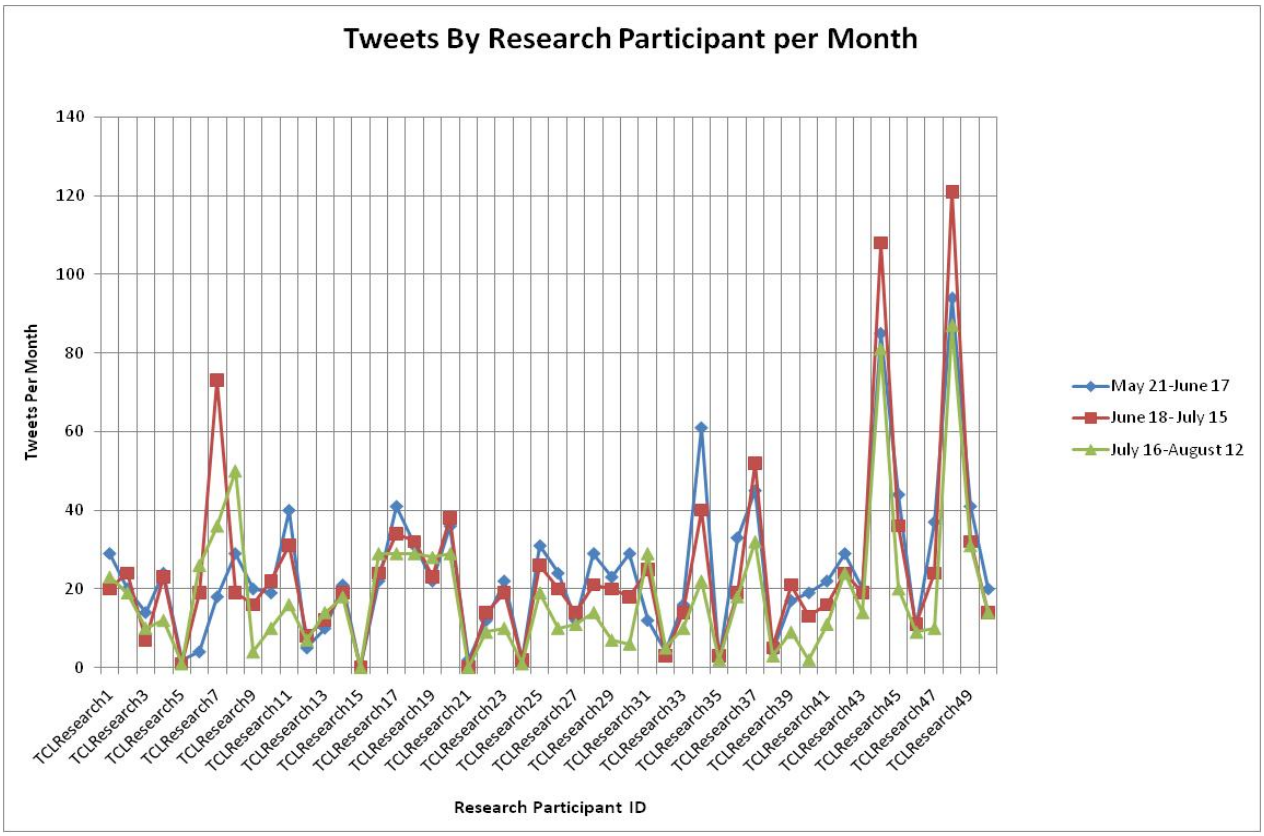


Figure 5.17

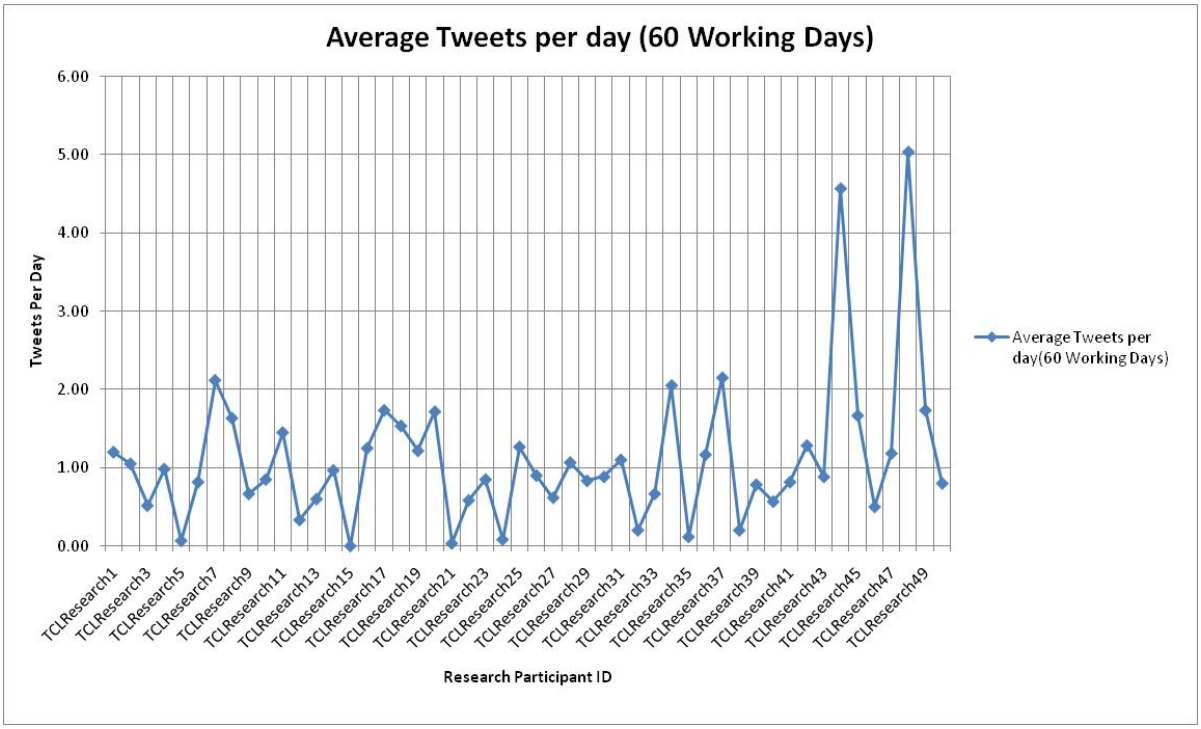


Figure 5.18

The average tweets per day by all study participants were 1.10. The range of the number of tweets was 0.00 – 5.03 per day. The second table shows the times each calibration test cell was mentioned in a Tweet in each month of the study using the prescribed hashtags.

Hashtag Used	Actual Name of Calibration Location	May 21-June 17	June 18-July 15	July 16-August 12	Total	Average Tweets per day (60 Working Days)
TCLCalCell1	Tech Center L Calibration Cell 1	25	23	13	61	1.02
TCLCalCell2	Tech Center L Calibration Cell 2	119	107	90	316	5.27
TCLCalCell3	Tech Center L Calibration Cell 3	52	49	50	151	2.52
TCLCalCell4	Tech Center L Calibration Cell 4	77	72	11	160	2.67
TCLCalCell5	Tech Center L Calibration Cell 5	27	31	10	68	1.13
TCLCalCell6	Tech Center L Calibration Cell 6	127	119	112	358	5.97
TCLCalCell7	Tech Center L Calibration Cell 6	33	35	29	97	1.62
TCLCalCell8	Tech Center L Calibration Cell 8	39	22	31	92	1.53
TCLCalCell9	Tech Center L Calibration Cell 9	27	36	19	82	1.37
TCGCalCell1	Tech Center G Calibration Cell 1	12	8	2	22	0.37
TCGCalCell2	Tech Center G Calibration Cell 2	71	34	46	151	2.52
TCGCalCell3	Tech Center G Calibration Cell 3	39	98	29	166	2.77
TCGCalCell4	Tech Center G Calibration Cell 4	144	141	112	397	6.62
TCGCalCell5	Tech Center G Calibration Cell 5	69	52	50	171	2.85
TCGCalCell6	Tech Center G Calibration Cell 6	64	53	42	159	2.65
TCGCalCell7	Tech Center G Calibration Cell 7	27	43	59	129	2.15
TCGCalCell8	Tech Center G Calibration Cell 8	12	10	10	32	0.53
TCACalCell1	Tech Center A Calibration Cell 1	2	3	1	6	0.10
TCACalCell2	Tech Center A Calibration Cell 2	106	104	94	304	5.07
TCACalCell3	Tech Center A Calibration Cell 3	32	26	13	71	1.18
TCACalCell4	Tech Center A Calibration Cell 4	31	39	39	109	1.82
TCACalCell5	Tech Center A Calibration Cell 5	8	6	3	17	0.28
TCACalCell6	Tech Center A Calibration Cell 6	65	88	45	198	3.30
	Total	**1208**	**1199**	**910**	**3317**	**55.28**

Table 5.8

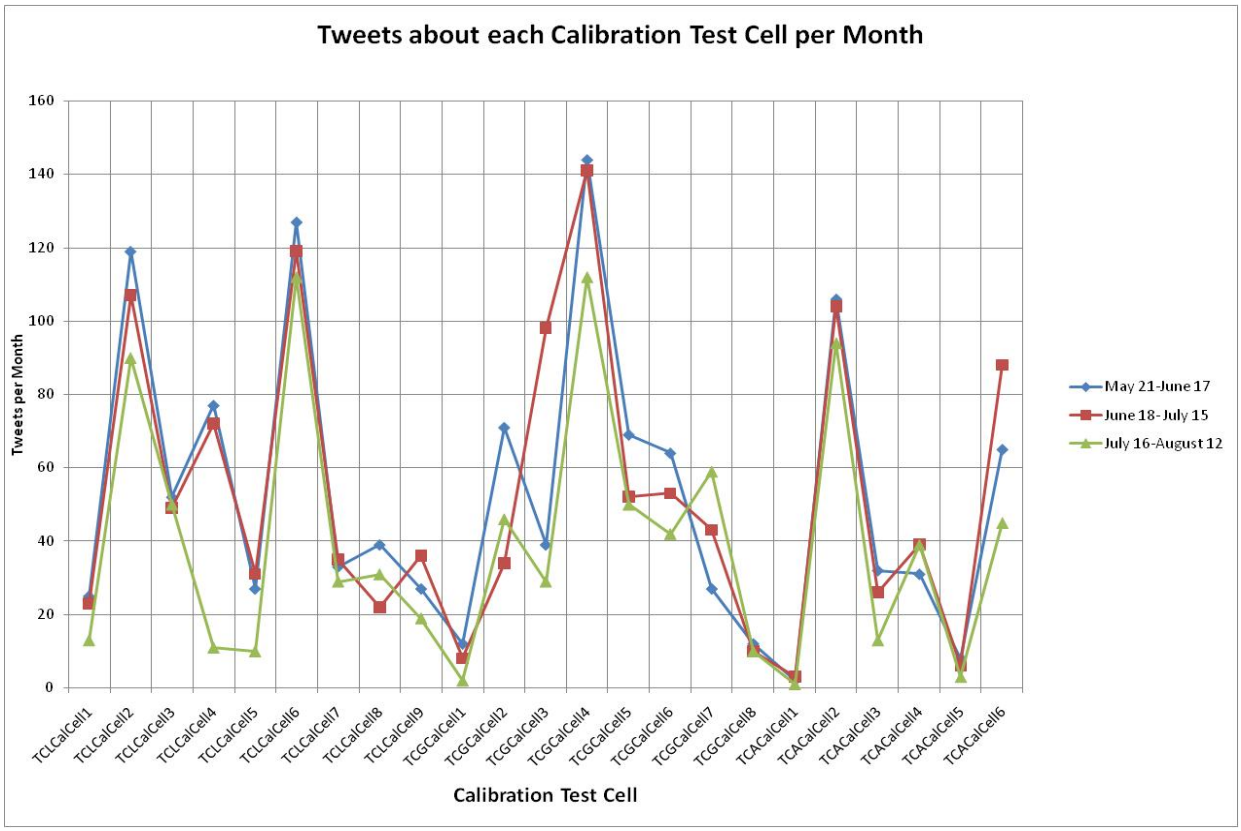


Figure 5.19

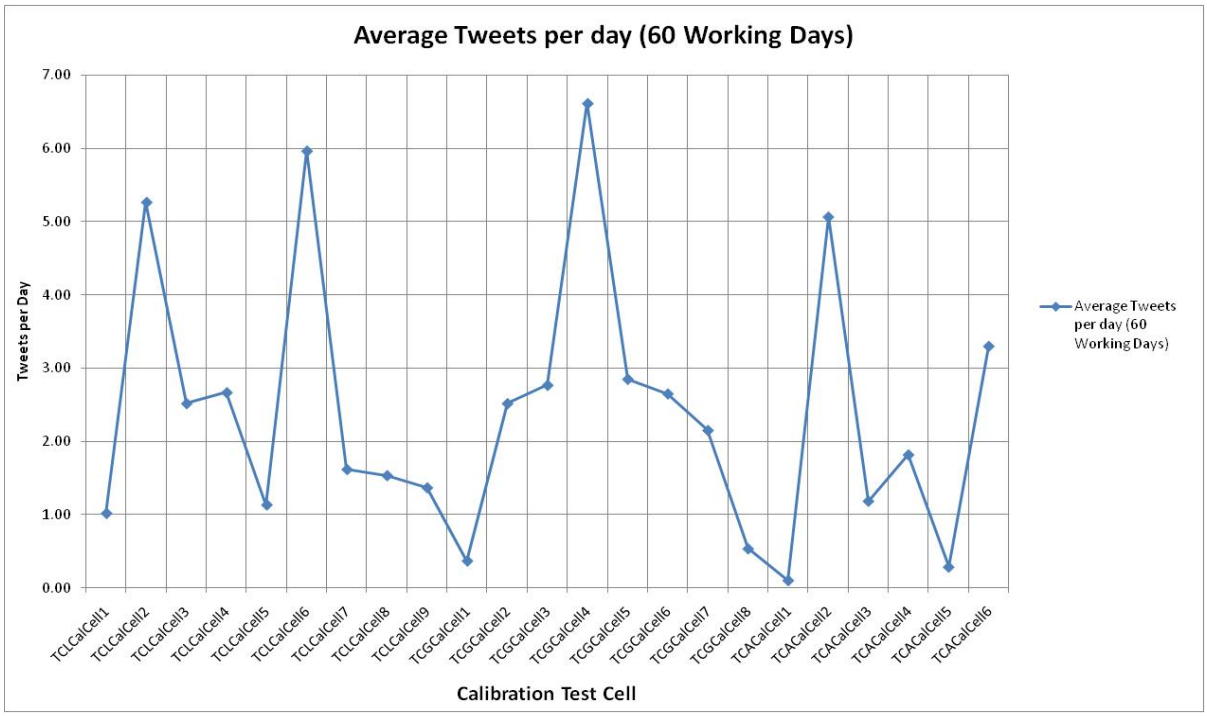


Figure 5.20

The average tweets per day for all calibration test cells were 2.40. The range of tweets was 0.10 – 6.62 tweets per day.

Summary

This chapter has provided the primary results of the research study and survey with supporting analysis and discussion. The data provided demonstrates that while the use of social media in a manufacturing workplace can have positive effects on the quality and delivery metrics, it is still not clear if these results would be similar in other business units or organizations. In addition to the impact that the study had on the quality and delivery performance, the examination and initial analysis of the survey data shows how the employee use of Twitter ranged from non-existent to extensive. These numbers do not allow for a complete explanation of why this was an occurrence but shows that employee engagement in the use of this tool was overall very high with a small number of employees engaging very little to not at all. Further and more comprehensive discussion will be included in the dialogue of Chapter 6.

CHAPTER 6

DISCUSSION AND FUTURE RESEARCH

Summary of Findings

The purpose of this study was to examine the relationship between the use of social media (specifically the use of Twitter) for workplace learning for problem solving and collaboration and the effect on quality and delivery performance in a manufacturing environment. The results of both the pilot study and the larger, empirical research study show there is a relationship between two. This study confirms that there is a statistical difference in performance metrics when the use of Twitter for workplace learning takes place in the work environment whereas the results from the pilot study also showed positive results but involved a much broader range of social media. The results from the research study reject the null hypothesis for both research questions showing that the introduction of Twitter for problem solving and collaboration in their learning process showed a positive relationship to quality and delivery performance. The Pilot Study and associated use of social media for learning delivered a measureable improvement in quality and delivery performance but the Research Study was more refined showing that the use of Twitter alone also had a significant positive impact on the workplace performance metrics, although not as pronounced as the Pilot Study. This difference indicates that future research using other and/or multiple forms of social media may yield improved results in those metrics.

Beyond the results for the experimental portion of the research study, the results from the online, anonymous survey also revealed other areas of interest and opportunity to be discussed later in this chapter. The purpose of the survey was to get a more accurate idea of how the members of the Experimental Group understood and appreciated the use of Twitter for workplace learning. The results showed that a large number of the employees enjoyed the use of

the social media platform and found value through its use while at the same time; there were a number of employees who clearly found its use to be a distraction and/or a waste of time. The number of employees who found value in its use far outweighed the number of those who found its use to be without merit or adding value to the workplace. As with any change in a process, a spectrum of employee experience and engagement is expected.

Discussion

This study worked within a major manufacturing organization that is divided into a number of business units, each operating as its own entity but still a part of the larger corporation. Although those business units operate in many ways as a separate body from the larger organization, they still fall under the control and loose oversight of the corporation, empowered to achieve the larger, organizational goals in whatever way they determine best for the individual business unit. Depending on the culture and leadership in each business unit, training can be well planned, thoroughly executed and wholly documented in some learning and development programs or may be loosely implemented and irrelevant in others. This study purposefully worked with those business units that have shown the latter, where the training program is not clearly defined and the majority of employee learning is as a result of the passing on of tribal knowledge from employee to employee through a number of means. Most of these training practices in these business units are not well controlled or documented and can employ a wide range of methods of learning. In these instances, this approach to learning can have dramatically variable results depending on the trainer and the new employee they are paired up with during the training process. Although this research showed marked improvements in both quality and delivery performance in this kind of business unit learning atmosphere, it cannot be known if similar improvements would be found in all business units, especially those with very

structured learning and development programs. As a result, additional research would be warranted to measure results across the entire organization and not simply one or two of the business units that are working alone as a microcosm of the larger organization. Regardless of the structure or limitations observed in this study, the results showed promise for a correlation between the use of Twitter and improved performance in quality and delivery metrics. Future research opportunities are plentiful using social media as a part of the training program in an organization. In addition, the use of the survey after the experimental treatment showed that while there were a relatively small amount of employees who did not care for the use of the social media platform in this was in the workplace; the majority of employees enjoyed having this venue available and hoped for continued use within their workplaces.

Findings with Regard to Research Questions

Research Question 1: *To what extent does the use of Twitter for workplace learning affect nonconformance (internal and external) metrics of this organization?*

Although the use of Twitter in the workplace for employee communication and collaboration did not yield the same level of results as what was experienced in the Pilot study, there were a number of factors that were different between the two studies that may have led to these differences. The Pilot and Research studies were completed using two different groups of employees in two different business units completing different work requirements. In addition, the Pilot study involved a number of social media tools whereas the Research study used only a single social media platform (Twitter). Regardless of these differences, the Research Study clearly showed that the use of Twitter in this way did have a positive effect on the nonconformance (internal and external) metrics of the organization. (See more detail discussion in sections below)

Research Question 2: *To what extent does the use of Twitter for workplace learning affect on time delivery (OTD%) metrics of this organization?*

Similar to the results discussed with Research Question 1, the study showed positive outcome when considering Research Question 2 regarding the on time delivery (OTD%) metrics of the organization. (See more detail discussion in sections below)

Quantitative Data

The quantitative data showed a connection between the use of Twitter for communication and collaboration and a positive effect on quality and delivery metrics. Upon the completion of the T-Test analysis of the data collected from MRDR and Cognos systems, a significant improvement in both quality and delivery performance was measured involving the Experimental Group. In the Control Group, there was a negligible change in these metrics from pretreatment to post treatment and any change experienced could be attributed to a normal ebb and flow of performance in the workplace. The goal for workplace PPM is to be as close to zero as possible. A reduction in PPM would indicate improvement in quality. The goal for On Time Delivery (OTD%) is to be as close to 100% as possible. An increase in OTD% would indicate improvement in delivery performance.

Experimental Group Data

The Experimental Group saw a 226.11 point PPM reduction through the MRDR system and a 219.17 point reduction through the Cognos system. Between the two measuring systems, the Experimental Group experienced an average of 222.64 point reduction. Beginning with a Pretreatment average of 927.67, this reduction post-treatment accounted for a 23.99% reduction in PPM performance. The Experimental Group also experienced a 2.16 OTD% increase through

the MRDR system and a 2.02% OTD% increase through the Cognos system. Between the two measuring systems, the Experimental Group experienced an average of 2.09 OTD% increase. Beginning with a Pretreatment average of 96.38%, this increase post-treatment accounted for a 2.17% OTD% increase in delivery performance. Both quality and delivery performance improved as a result of the treatment in the experimental research. Although not as large of changes as experienced in the Pilot Study, these results not only show a relationship and are significant.

Control Group Data

The Control Group, on the other hand, saw a 15.79 point PPM reduction through the MRDR system and an 11.47 point reduction through the Cognos system. Between the two measuring systems, the Experimental Group experienced an average of 13.63 point reduction. Beginning with a Pretreatment average of 1060.41, this reduction post-treatment accounted for a modest 1.29% reduction in PPM performance. The Control Group saw a 0.12 OTD% increase through the MRDR system and a 0.07% OTD% increase through the Cognos system. Between the two measuring systems, the Control Group experienced an average of 0.095 OTD% increase. Beginning with a Pretreatment average of 96.35%, this increase post-treatment accounted for a 0.099% OTD% increase in delivery performance. Although these metrics appear to show improvement, the results are likely a result of the typical changes experienced in any manufacturing environment and were not a result of the experimental research treatment. As shown with the complete data analysis in Chapter 5, these results are not considered significant.

Survey Data

Once the research study had been concluded, the Experimental Group was asked to participate in an anonymous, online survey consisting of 8 Likert scale questions and 5 open-

ended questions. This survey was hosted through SurveyMonkey allowing the participants to log in to the survey at their convenience within the timeframe designated. Of the 50 Experimental Group participants, only 48 chose to complete the survey. Below is a brief discussion of the results of the survey.

Likert Scale Questions

Question 1 - The Use of Twitter helped me complete my job on schedule

The results of this question showed a normal distribution with 45.83% of the respondents reporting a neutral answer. Although 29.17% indicated that they agreed compared to the 16.67% disagreeing, overall, the results were mostly inconclusive. This shows that a slightly larger number of respondents had a favorable view of Twitter helping them but the small percentage difference and a high number of neutral responses do not show a strong argument for any conclusion. In this case, it appears that the employees were not convinced that the use of Twitter helped them complete their job requirements on schedule.

Question 2 - The Use of Twitter helped me complete my job with fewer errors

The results of this question showed that the majority of respondents (72.91% agreeing or strongly agreeing) found that the use of Twitter helped them perform their job with more accuracy. Unlike question 1, the results of this question clearly indicate that the employees found the use of Twitter in this way was very favorable. It was overwhelmingly clear that the employees felt very strongly that the use of Twitter helped them perform in their jobs more accurately. As a result, the use of Twitter in this way likely helped drive down the quality PPM metrics observed in the last section.

Question 3 - The Use of Twitter caused distractions in my daily work routine

The results of this question showed a normal distribution leaving these results inconclusive. The results from this question were almost perfectly neutral while resulting in 37.50% of the respondents having a neutral view of the use of Twitter in this way. The results do raise a concern that some of the employees' perception was that Twitter caused a distraction in their daily work routine. If a focus group had been able to be administered, follow up questions could have identified how these employees saw Twitter as a distraction. This may be an area for future research.

Question 4 - The Use of Twitter was valuable for completing my job requirements

The results of this question showed that the majority of respondents (64.59% agreeing or strongly agreeing) found that the use of Twitter helped them perform their job with more efficiently. Although this question showed very favorable, it is unclear why employees felt it was valuable for completing their job requirements yet were not sure that Twitter helped them stay on schedule, as discussed in question 1. If a focus group had been able to be administered, follow up questions could have identified how why the employees found Twitter valuable in this way yet not in staying on schedule. By being more equipped to complete the needs of the job, this likely helped drive down the On Time Delivery (OTD%) metrics observed in the last section.

Question 5 - The Use of Twitter has made me more competent in my job performance

The results of this question showed that the majority of respondents (60.42% agreeing or strongly agreeing) found that the use of Twitter helped them perform their job better. In addition

to this percentage, the remaining 39.58% remained neutral and no respondents reported that they disagree or strongly disagree.

Question 6 - The Use of Twitter showed me that the company wants to help me become better at my job

The results of this question showed that a large number (37.50% agreeing or strongly agreeing) found that the use of Twitter was an indicator that Organization X wanted to use this form of learning to help them perform their job requirements better. Also reported were 50.00% of the respondents remained neutral in this question where 12.50% reported that they disagreed or strongly disagreed. Although there is a slight majority of respondents that feel the use of Twitter was a sign that their company wants to help them become better at their job requirements, much like question 1, there was no overwhelming support for this question. If a focus group had been allowed, more information into the responses of this and all of the questions could help identify areas of opportunity in the use of Twitter in the workplace.

Question 7 - If Twitter is allowed to be used after this study, I am very likely to use it for daily work requirements

The results of this question showed that the majority of respondents (52.08%) remained neutral in this question while 31.25% agreed that they would continue to use Twitter in the future, if allowed. No respondents strongly agreed to it extended use.

Question 8 - Before this study, how often did you use Twitter.

The results of this question showed that the majority of respondents (79.17%) use Twitter prior to this study at least daily. Only 4.16% reported using it only on weekends or occasionally

but 16.67% reported that they had never used the social media platform prior to beginning this research study.

Open Ended Questions

nVivo software was used to analyze the open ended questions using qualitative analysis. The graphs shown in Chapter 5 are in the form of a Pareto chart showing the terms most used in sequential order, from words used most often to least often, from left to right. Raw data from the open ended questions can be found in "Open Ended Question Data" (APPENDIX H). In addition, word clouds the use of nVivo can be found in APPENDIX I and Hierarchy Tables can be found in APPENDIX J. The word clouds and hierarchy tables give a visual representation to the responses given in this section.

Open Ended Question 1 (Survey Question 9) –What did you like most about the use of Twitter for the workplace?

The results of this question showed that the majority of respondents (43.75%) found Twitter easy to use. 16.67% found that through the use of Twitter, support they needed seemed to be more readily available. 14.58% found it fast to use and 12.5% found it convenient. This information is helpful for potential future use of Twitter in the workplace. Because of the simplicity of the use, employees will not likely have a challenging learning curve to overcome to experience the overall benefits of its use. The logistics of the calibration cells at Organization X require the individual cells to be located varying distances from one another. To try to get any information by walking between these calibration cells takes significant time and slows the productivity down. The results of the survey question may have also helped for the opinion whether the participants will continue using Twitter after the research study has concluded, if possible for work related tasks.

Open Ended Question 2 (Survey Question 10) –What did you like least about the use of Twitter for the workplace?

The results of this question showed that 27.08% of the respondents found the use of Twitter to be some form of distraction. 16.67% had no comment. 14.32% said that because of the use of the social media platform, they felt they were able to do their jobs better but 8.33% also relied on their phone for support. 6.25% said they found the use of Twitter an opportunity to help others who need it while another 6.25% were able to complete the requirements of their job more quickly. 2.08% said they avoided their phone as a result of the use of the social media platform. Because this study was relatively short, the feeling that the use of Twitter was a distraction may have been overcome in a longer research study as the participants became more accustomed to having it available and used in the workplace. The use of Twitter does add an additional task that was not completed in the same way before. Communication and collaboration before the use of Twitter required employees to walk from test cell to test cell, often requiring up to a half hour for the process to be completed. Communication though this form of social media was likely higher as a result of the convenience of having each mobile device immediately accessible, reducing the time needed to get the information needed by the employees. In addition, because of the novelty of the use in this study, the overall use was likely significantly higher, especially in the beginning of the study.

Open Ended Question 3 (Survey Question 11) –How did you change the way you work as a result of the use of Twitter in the workplace?

The results of this question showed that 43.75% of the respondents found the use of Twitter gave them the feeling that help was close, if needed. 18.75% indicated that because of its presence, other employees were less likely to try to complete the job without reaching out

through Twitter. 16.67% said that because of the use of the social media platform, they checked their phones more often coupled with 1.42% finding that they needed to charge their phone more often. Much like the responses to the previous question, participants of the study overwhelmingly realized that although the use of Twitter was somewhat of a distraction, the sense of knowing there was immediate help via social media was also appreciate. Unfortunately, true or not true, the sense of some employees having the feeling the others were not trying to do their jobs without help or support that could be gotten easily from the use of Twitter was present in nearly a fifth of the participants.

Open Ended Question 4 (Survey Question 12) –Explain, in detail, how Twitter affected how you completed your job requirements.

The results of this question showed that 35.08% of the respondents felt that because of Twitter, they were better trained to do their jobs, 18.75% could get help easier, 16.16% saw an improvement in communication while 10.42% felt they knew their coworkers better and another 10.42% felt more confident in their work ability. Another 10.42% had a negative perception to how the use of Twitter affected how they worked. Overall, most employees saw value in one or more ways through the use of Twitter in the workplace.

Open Ended Question 5 (Survey Question 13) –Please share any other comments about the use of Twitter in the workplace.

Of the 48 survey respondents, only 10 chose to answer this question. 12.10% (58.08% of the ten respondents) said they liked the use of Twitter, 4.17% (20.02% of the ten respondents) said to get rid of the social media platform and 2.08% (10.01% of the ten respondents) said they wanted to try something else. Although slightly over a fifth of the respondents indicated that they would like to see the use of Twitter be eliminated in this way, a vast majority of the

respondents indicated that they enjoyed the use. The limited responses offered for this open ended question were very strong. The responses were either very much in favor of the use Twitter in the workplace or very against it use.

Twitter Analytics

Analysis using Twitter Analytics application inside of Twitter was able to reveal a number of details about the use of Twitter by each of the Experimental Group participants and how often each calibration location was mentioned. Prior to the beginning of the research study, each participant in the Experimental Group was assigned a User ID ranging from TCLResearch1 – TCLResearch50. Each participant used a private and anonymous Twitter ID. In addition to the unique user ID's, each Calibration Cell location was assigned a unique hashtag to better identify which areas were tweeted about and how often they were tweeted. A full list of the User IDs and hashtags were listed Chapter 5.

Data involving the number of tweets per user ID was collected and recorded by the month. The average tweets per month for all three months were 1.10 per day with a range of 0.00 to 5.03 tweets per day per user with a total of 3317 tweets by all users over the three month period. Over the course of the study, the number of tweets gradually reduced from 1208 in the first month, to 1199 tweets the second month to 910 in the final month. The use of a focus group could have identified why this phenomenon was taking place and it origin, with work related or employee related. One potential cause for the reduction of tweets over the research period could be due to employee scaffolding. As the results showed, the employees had become more of a unit working in the larger organization rather than individuals or teams working isolated in their individual test cells working together to help each other become stronger in their job roles. The use if Twitter in this way mimics peer to peer communication and collaboration showing that

being physically face to face is not required to work effectively as a unit. As what would be observed in any cross section of society, communication in this form or any other had a broad range of engagement. In most instances, there are those members of a group who communicate a great deal and others who choose, for whatever reason, to communicate on a lesser scale. User TCLResearch47 was the highest user over the period averaging 5.03 tweets per day (considering a 60 work day schedule over the period of 3 months) amassing a total of 302 tweets over the research study period. User TCLResearch44 averaged 4.57 tweets per day sharing 274 tweets over the study period. User TCLResearch15 had no tweets recorded over the entire period.

Tweets mentioning specific test cells using the assigned hashtags also saw a broad variability in use. A total of 3317 total tweets over the period averaging 55.28 tweets per day were experienced. Regardless of the month being examined, there were 5 calibration test cells that showed very high tweet counts. On the other hand, there were 6 test cells that were mention in an average of 1 or less tweets per day. This is valuable information as this data can be used to examine why those cells (high and low tweets) saw the results that they did. Training of the employee in the cell, the complexity of the calibration in the particular cell or other variables may indicate a need for attention to make those highly tweeted cells become more capable of operating more autonomously, requiring reduced levels of outside support that can cost the organization production time and potential quality and delivery concerns. On the other hand, those cells that were tweeted about very little may have employees, associated training and more robust and relevant processes that could be translated to the other cells, making them operate requiring less intervention and support from outside sources similar to these calibration cells. As seen in this instance, the data generated by graphing the data regarding the number of tweets per calibration cell can offer a form of “low hanging fruit” that could be addressed to identify the

those areas that need additional support and/or training or the areas that appear to be working with little intervention and capture what makes these areas work well.

Findings related to Current Research

As discussed previously, this area of research is relatively unexplored, especially in manufacturing. Although the findings of this study could easily translate to other forms of business and service organizations, this research is relatively new in the areas measuring quality and delivery in manufacturing. The results from this study are encouraging and regardless of the kind of organization that may consider the implementation of the use of social media for learning, communication and collaboration, businesses of all kinds could experience similar benefits as experienced in this research study. The dynamics found in this study could easily translate to any form of organization.

Importance of Findings

The findings of this research study are significant and increasingly relevant as social media continues to get a larger foothold in the daily work activities of most organizations, regardless of the goods or services those companies provide. As mentioned in the last section, although this research was completed in a manufacturing environment, the results are important in nearly every sector of business. Additional research can and should be completed to get a better understanding about how the use of Twitter (or other forms of social media) can affect the overall performance of an organization. Considering the results that were found in this research study and the low cost of use to implement social media use in the workplace, many organizations may find the use this digital platform for learning, communication and collaboration. Its use may also help maintain their overall organizational performance while maintaining and favorable budget as they complete in a highly competitive global marketplace.

Competition continues to become more aggressive and using a tool that can position an organization to perform more effectively and efficiently while reducing training and developing costs should be welcomed by countless organizations and business units throughout the world.

Limitations of Study

Although this research was carefully prepared, there are still some limitations and shortcomings to consider. First of all, the research was conducted in a single business unit of a much larger organization comprised of hundreds of units. The results of this research may be limited to the conditions found in that individual unit and may or may not translate to or be representative of other areas of the entire organization or a completely different organization altogether. Because of the independent conditions found in that individual unit and the variability between business units, without additional research on a larger, more inclusive scale that traverses multiple business units, the results found in this study likely do not reflect what may be experienced on an organizational level. Second, twelve weeks is not enough time for the participants to become fully acclimated with the use of social media in the workplace. Those who found it cumbersome or a distraction may begin to appreciate its use over time and those who have the initial liking to the use may ultimately discover that it is not the tool they initially thought it was. A study of longer duration would ensure that these considerations were taken into account. In addition, although every attempt was made to ensure that other seasonal or temporary situations that may affect the study results were eliminated completely or mitigated, a longer term study would be more likely to account for and identify any performance peaks and valleys that any organization may encounter over the period of a year or more. Third, the experiment only involved 50 experimental participants and the organization, as a whole, has over 110,000 employees world-wide. The experimental groups accounted for only 0.04545% of the total workforce population of this organization. A much larger scale study would help ensure that

the findings that were experienced. Finally, since the analysis of the pretest and posttest data was conducted by the author himself, a certain degree of error without a secondary check was possible. Although the data was reviewed a number of times before adding it to the research report, a higher level of confidence in the analysis would have been possible with 2 or more researchers analyzing the work and comparing the results to ensure they are the same.

Strengths

This research study allowed for the evaluation of the treatment and its effect on quality and delivery metrics in a very simple and accessible way in an organization that has a number of business units to experiment with. Although there were a number of statistical methods that could have been used, the use of the Paired T-Test to compare the two means (Pretest and Posttest results) of each of the groups (Control and Experimental) served in an efficient and accurate way to determine if the treatment had any measurable effect. Research while deciding which statistical tool to use for this study showed that the Paired T-Test would be the best match for the work that was being completed as a part of this research. The Soloman Four-Group Design was also considered but dividing a single work division into 4 equivalent subgroups that would be large enough to offer validity to the research was impractical if not impossible.

Since the employees in both the experimental group and control group work in the same conditions with the same supervisors and managers, the variables between the groups are greatly reduced. The threat of history as a risk was controlled by having the experimental and control group operate in similar environments over the same period of time. This was further reduced by choosing the members of the experimental and control groups from the same population within the same business unit. At the same time, as a result of the proximity of the experimental and control groups, additional risks (see Weaknesses below) may been introduced. Intrasession

history is also eliminated as a threat as the data collection from both groups is done automatically through the MRDR (Material Rejection & Disposition Report) and Cognos system. The use of multiple researchers is not needed for successful completion of this research as a result of the automatic collection of multiple forms of data. The existence of abundant amounts of historical data is present and can give a strong baseline to compare pretreatment to posttreatment. Since the data is continuously being gathered in an automatic means and electronically, there is little chance of error as a result of data collection or interpretation or either historical data or data collected after treatment.

The use of a survey was successful in allowing the researcher to better understand the perceptions of the use of Twitter in the workplace from the viewpoint of the participants of the research study. Although some areas of the survey produced inconclusive results, many of the questions showed that a large number of the Experimental Group participants enjoyed the use of Twitter for workplace communication and collaboration and noted that its use allowed them to do their jobs more efficiently with less error. The open-ended questions gave a more unique insight to the feelings that users had about the use of Twitter in a manufacturing workplace. The results supported that the majority of the employees found value in the use of this social media platform while a small number of participants were not convinced of the need of this learning tool. Ultimately, many of the participants found its use beneficial and would be willing to use it on a long term basis, if available.

Weaknesses

One weakness with this research setting is that experimental and control groups work very closely together and the control group most likely understands that their fellow coworkers who are part of the experimental group are allowed to use Twitter as a part of their daily jobs

whereas they are not allowed to access these platforms. This may lead to skewed data and perhaps some resentment of the control group causing abnormally high nonconformance rates and reduced delivery rates. Although this was not observed in this research study, the potential is present. This situation increases the likelihood of interaction of selection and treatment. The control and experimental groups are from the same work area of the same division minimizing this effect since the work environment, supervision and management team are the same for both groups. Although this may be considered a potential risk to the study, the setting treatment interaction concerns will likely be minimal and the environmental conditions or settings under which a future study may be conducted will not likely be capable of being adequately duplicated in other settings. The experimental and control groups may or may not interact between one another but this interaction is not likely to affect the research results and is mitigated through Placebo Control.

The removal of the "Neutral" option in the Likert scale section of the survey would require the survey taker to make a more thoughtful decision about each question rather than either opting out of answering the question or wanting to take the quick route to completion of the survey. Considering the large number of neutral responses in this study, the elimination of this category would help refine the results more clearly, especially in instances when a focus group is not possible to follow up on these kinds of responses. There is a great deal of controversy involving the use of "Neutral" and in situations similar to this research setting where the focus group was not able to be completed, the removal of "neutral" would be justified to help make the data collected from the Likert scale questions more meaningful.

Unfortunately, both the union and company that are involved in the organization were strongly reluctant to allow focus groups to take place. Although focus groups are to be

confidential, it is impossible to completely control what is discussed in them and after the participants leave. Both groups (union and company) felt that information shared in this way could have an adverse effect on the employee, depending on what was discussed. In addition, there was a concern that the participants would not fully engage in the focus group, "holding back" information to protect themselves and their reputation. The focus group would have been able to allow a much deeper investigation into the employee perspective and allow the use of follow up questions where the open-ended question of the survey simply cannot. In future research, the use of a focus group would be beneficial, if possible. Although the survey produced valuable data, a number of the questions that were part of the survey were unable to provide any conclusion to the questions asked. As discussed earlier, many of the survey questions would have benefitted from follow-up questions. The exploration through the use of these follow-up questions would have clarified some of the survey questions that resulted in inconclusive results. These questions could allow the researcher to drill down into how the use of Twitter was perceived by the Experimental Group.

Lessons Going Forward

The research study provided a number of areas that could be improved upon moving forward. In future research, finding two or more business units that are similar in terms of longevity, experience and management would be ideal to ensure that communication between the experimental and control groups are kept to a minimum. Unfortunately, within the organization where these business units would be located, it is common for employees to interact between business units so the risk of the interaction between the experimental and control groups is a constant risk. Although there are similar business units in different parts of this organization, many are placed throughout the world and cultural differences would also have a dramatic effect

on how the some research studies may be executed and the results that may come from those studies. Although the introduction of uncontrollable variables as mentioned would inevitably take place, the large scale experiment either in a division or region would offer a much larger sample size and cross section of the organization. Perhaps, the introduction of these variables could allow a much more accurate evaluation of the treatment and resulting effects instead of those results found in a microcosm. Finally, as mentioned previously, the use of a focus group, if possible, would make this study more robust and yield much more meaningful data. Although the survey produced very good results, the absence of follow-up questions also limited how deeply we could peek into the inner thinking of the participants. The use of follow-up questions through a focus group or by using a larger, farther reaching survey would help make some of the results and thoughts of the participants better understood.

General Conclusions from Study

The data from the larger, quantitative portion of this research study showed the positive potential of the use of Twitter for workplace learning, communication and collaboration. Although many limitations and weaknesses to this experimental study have been noted, the quantitative results show positive results and suggest how many organizations could greatly benefit from the use of social media in the workplace. In many ways, the use of social media in this way was collectively building a knowledge network from which they members of group currently using it and others can draw from. In addition, these results and the aforementioned limitations also support a need for much more research in this area to help get a more accurate and complete understanding about the relationship between the use of social media and the workplace. The results are promising and demonstrate that the use of social media in this way could help some struggling organizations control some of the costs associated with their training

and development programs while offering their employees a real time venue to communicate and collaborate in a very meaningful way. The results of the survey, while somewhat limited, did show that most employees saw value in the use of social media. While others found the use to be a waste of time, overall, employee reception, use and engagement in this social media platform was good. The ease of the use of this form of learning would only help encourage these and other users in the use of this tool to perform their job functions leading to reduced errors and increased delivery. Although this study was focused on manufacturing, similar results could be found in many other organizations, especially those where the employees are separated by many feet or even in other areas of the world.

Implications

Research results indicate that the use of social media in the form of Twitter can affect the quality and delivery performance within a manufacturing workplace in a positive way. In fact, the average percentile improvement in this research shows a 2.09% improvement in delivery performance and a 222.64 point reduction in quality PPM performance between the two recording systems (MRDR and Cognos). This translates to 24.38% reduction in average quality performance as a result of the treatment of this research being introduced. In a global economy that is larger and more competitive than ever before, these improvements can help an organization become more competitive and efficient to succeed for the long term.

IMPLICATION 1: The introduction of modern and engaging learning curricula and learning methods can help improve the performance of an organization.

> Specifically, learning-related KM practices increase organizational performance through the following mechanisms. By enabling improving access to collegial

> tacit and explicit knowledge they increase the quality of performance. By legitimizing vicarious learning they increase the motivation to share and create knowledge (Kianto, Ritala, Vanhala, & Inkinen, , 2013, p. 358).

Overall, the ease of use of the social media platform was reported by all employees who were part of the Experimental Group. Although a small percentage found the use of Twitter in this way to be a distraction, most said they felt as if it helped them do their jobs better. In addition, most also said they enjoyed that help and resources were just a few keystrokes away on their mobile device.

IMPLICATION 2: Social learning continues to offer an organization a way to reach employees in effective ways.

> Amazingly rapid expansion of the content sharing technologies has led to many of social media technologies becoming an integral part of many people's daily routine. We can easily collaborate and work with our colleagues at the opposite side of the world with the help of professional, fast instant messaging services in an effective way (Gaál, Szabó, Obermayer-Kovács & Csepregi, 2015, p.197).

Social learning for a number of years involved face to face interaction however, social media is becoming a venue that allows similar interactions without the need to be in the same room or same country. Social learning was found to be successful in this research study though the use of Twitter. Although the use of Twitter was new to some of the employees who took part in the research study, its use was embraced by the majority of the participants. The employees involved in this study found that help was available and they were able to perform their job requirements better and with more confidence as a result of its use and presence in their daily work environment. As the research results show, this form of communication and collaboration can

help organizations perform at higher and more successful levels. As social media continues to evolve, so will the ways that employees will learn and interact at their job places. As more organization migrate to using more remotely based employees, this form of communication and collaboration should only get more utilized in the workplace.

IMPLICATION 3: Social Learning in the workplace can be achieved through social media.

> We live in a period of time seen as the beginning of social learning development, based on social media. Web 3.0 in turn is supposed to have enriched the previous generation by a certain 'understanding of the context' of the presented information, thus filling the communication gap between a man and a computer through the use of social media leading to a more complete learning experience (Łuczak, 2015, p. 3).

The results from this research study show that learning did, in fact, take place as validated through the quality and delivery metrics. The use of Twitter in this way showed how social media can be used to help complement current training methods, allowing a new and contemporary venue for employees to interact with one another. This study was an example that used a small amount of employees for a short time and additional research is needed to understand the effects of social media in larger groups of employees over the long term. The potential opportunities could be limitless if additional research is completed.

IMPLICATION 4: The majority of employees enjoy the use of social media in the workplace for employee development.

The survey results showed that while some employees clearly did not care for the use of social media to help them complete their job related needs, the majority of the

employees found value in its use. These employees indicated that help they may need was more readily accessible and they felt more confident in knowing their job requirements. In addition, the study participants strongly advocated that communication (both through Twitter and outside of it) appeared to become stronger. Although some employees stated that its use could cause a distraction to the workplace, future research may show that its continued use will become more comfortable and acceptable for all employees. The results of the survey indicated that the benefits of the use of social media used in this way outweigh the burden of the distraction.

Future Research

This research shows a relationship between the use of Twitter and quality and delivery performance and there are clearly more opportunities for explore these associations at a deeper level using more participants, having a longer timeframe for the research study and comparing the results between various business units to see how they compare. Unfortunately, there are many gaps in current available research in regard to any relationship between the use of Twitter and quality and delivery performance and leaves significant room for future research. The research contained in this study is a small part of what could be discovered through more deeply examining these relationships. Future research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can significantly lead to additional studies examining these relationships while using the same methodologies but on a larger scale. The outcomes of this research may aid many organizations in the decision to use Twitter as a platform for use in problem solving and

collaboration in their organizations, resulting in potentially more effective training and better performance in the global economy.

Other future research studies could pick up where the Pilot study left off. The use of other social media platforms in a similar way as Twitter was used in this study could also show which form of social media could lead to the highest performance gains in regard to quality and delivery. In the Pilot study, the following forms of social media were used:

- The use of Twitter for problem solving was allowed and encouraged
- The use of texting between employees and outside of the organization for problem solving was allowed and encouraged
- The use of smartphones to use Google and other search engines for problem solving was allowed and encouraged
- The use of YouTube for problem solving was allowed and encouraged
- A group Facebook page was created to allow interaction, collaboration and communication was allowed and encouraged.

Future research could also involve a single or multiple forms of social media that were used in the Pilot Study to better understand if any one form of social media or a combination of them can offer similar or better results that the empirical study. Although the final research study only considered the use of Twitter for workplace learning for problem solving and collaboration and the effect on quality and delivery performance in a manufacturing environment, the other forms of social media and YouTube may also contribute in their own right to marked improvement in the metrics being measured. Depending on the circumstance, YouTube is not always considered a form of social media but its use and availability may also be an excellent way for employees to harvest much need information through the accessibility of instructional videos that can be found

there. In addition, future research may show that a variety or blending of various forms of social media used for workplace learning may provide even more positive results in measurable metrics than a single form of media. Taking into consideration that this research study only evaluated performance changes for internal customers for a single business unit in a single organization, future research could help measure these metrics (quality and delivery performance) on a much larger scale, including the effect of this kind of training on the external, end user outside of the organization of the products or services being provided. Because of the lack of research on this area and the continued expansion of the use of social media in the workplace, a unique opportunity presents itself to provide a clear palette from which to build from and an infinite amount of future research that could be conducted in this area to benefit countless organizations exists to be examined.

Conclusion

This study successfully showed a relationship between the use of social media in the workplace and its effects on manufacturing metrics including quality performance (PPM) and on time delivery performance (OTD%). The Pilot Study showed a strong relationship that yielded very positive relationships between the two aforementioned variables but also utilized a large number of social media venues making any relationship between the use of social media and the performance results difficult to interpret. Because of this difficulty, there was little confidence in understanding of what one (or combination of multiple) social media venue(s) actually contributed to the improvement observed in the quality and delivery performance. As a result, the later, Empirical Study, reduced the number of social media venues used to one (Twitter for communication and collaboration) to help eliminate the confusion experienced in the Pilot Study. The Empirical Study did reveal that when the employees communicate and collaborate through

the social media platform (Twitter), its use allowed them to operate in a more accurate and timely manner, achieving more satisfactory performance results identified as critical success factors in that business unit. While improvements in quality and delivery performance was observed in the Empirical Study, it was at a lower level than those observed in the Pilot Study, indicating that other venues of social media likely contributed to the difference experience in workplace performance. These differences indicate that there is opportunity for significant future research available in this relatively unexplored area of employee development to better understand if a single or combination of social media tools would deliver the best performance in the workplace.

Combined with the Empirical Study outcomes, the results of the online, anonymous survey showed that the use of social media could lead to positive performance changes in the workplace while engaging the employees at a level that may not be available without this form of communication and collaboration. The survey responses also revealed that some employees were not enthusiastic in the use of Twitter for use in the workplace, however, the vast majority of participants of the study enjoyed and embraced the use of social media for workplace needs. This embracing of the use of Twitter by the employees who partook in the Empirical Study could indicate that the use of social media, in the form of Twitter or other, could also help to increase employee engagement while making the manufacturing process more efficient.

Considering the rapid expansion of the use of social media in daily life and its continued expansion through the workplace, it appears to be inevitable that its use in the workplace for many uses, both currently known and unknown, will proliferate organizations throughout the world. As the results of this research have shown, the use of social media in a variety of ways can impact the performance of a workplace. Further research into the effective use of social

media for learning and employee development can help businesses throughout the world better understand how its use may have significant positive performance and financial impacts on those organizations that choose to utilize it. Likely, due to a lack of understanding of the abilities and resources associated with social media coupled with fear of misuse of the Internet access in the workplace, many organizations have no idea how its use, when implemented correctly, can help increase organizational profitability and market share. In many cases, the use of social media has little to no cost associated with it and the connectivity through mobile devices makes this tool a powerful resource to help employees complete their job related needs. As global competition continues to become more challenging, demanding and time sensitive, the use of social media as a learning and/or communication/collaboration tool may offer these organizations a way to perform more efficiently while engaging their employees at a level that may not be possible using traditional learning and communication means. The understanding that can come from continued research could be the difference between an organization being successful or failing.

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APPENDIX A

CONSENT FORM

SOCIAL BEHAVIORAL RESEARCH CONSENT FORM

Research Information and Consent for Participation in Social Behavioral Research

SOCIAL MEDIA FOR LEARNING AND ITS EFFECT ON QUALITY AND DELIVERY IN MANUFACTURING WORKPLACES

You are being asked to participate in a research study. Researchers are required to provide a consent form such as this one to tell you about the research, to explain that taking part is voluntary, to describe the risks and benefits of participation, and to help you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Principal Investigator Name and Title: Dr. William Cope, PhD
Department and Institution: EPOL, College of Education, University of Illinois – Urbana-Champaign
Address and Contact Information:
326 Education Building
1310 S. Sixth St.
Champaign, IL 61820
217-244-4157

Why am I being asked?

You are being asked to be a subject in a research study about a relationship between the implementation of social learning and quality metrics (including rejection rates and on time delivery), employee job satisfaction and self- efficacy in a manufacturing workplace. There is little research in this area and could offer valuable insights for those manufacturing organizations who are considering the use of social learning in their workplaces.
You have been asked to participate in the research because you are an employee of a business unit within the organization where the research is taking place. There is absolutely no risk to the relationship with your employers by your decision to participate or not participate in this research.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with the University of Illinois at Urbana-Champaign. **If you decide to participate, you are free to withdraw at any time without affecting that relationship.**

Approximately 100 subjects may be involved in this research through UIUC.

What is the purpose of this research?

The purpose of this study to is examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. Gaps in current available research and the infancy of social media in the workplace leave a great deal of the relationship misunderstood. This research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can aid many organizations in the decision to use social media in their organizations.

What procedures are involved?

This research will be performed at the Mossville IL Campus (2 different business units will be asked to participate), East Peoria Campus (3 different business units will be asked to participate) and the Peoria Proving Grounds.

The research will be conducted as a controlled quantitative research study in which data are collected before and after the intervention. In this study, the same sample of employees will be used for the pre-intervention and the post-intervention. The intervention is the introduction of social media into the learning employee/development program. Social media in the learning employee/development will be as follows:

- The use of YouTube for problem solving will be allowed and encouraged

The study will last for 3 months, with the previous 2 years of data being used for pre-intervention, and the 3 months of social media for learning employee/development being the intervention. Data will be collected post-intervention in the same manner as pre-intervention.

What are the potential risks and discomforts?

To the best of our knowledge, the things you will be doing have no more risk of harm than you would experience in everyday life. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to not answer questions you do not wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with the organization or the University of Illinois or with any other participating institutions or agencies.

Will I be told about new information that may affect my decision to participate?

During the course of the study, you will be informed of any significant new research information (either good or bad), such as changes in the risks or benefits resulting from participation in the research or new alternatives to participation, that might cause you to change your mind about

continuing in the research. If new information is provided to you, your consent to continue participating in this research may be re-obtained.

Are there benefits to taking part in the research?

You may not directly benefit from participation in the research but your help in the research can help further changes to the workplace that could affect you and other employees.

What other options are there?

You have the option to not participate in this study

Will my study-related information be kept confidential?

Yes, but not always. In general, we will not tell anyone any information about you. When this research is discussed or published, no one will know that you were in the study. However, laws and university rules might require us to disclose information about you. For example, if required by laws or University Policy, study information which identifies you and the consent form signed by you may be seen or copied by the following people or groups:

- The university committee and office that reviews and approves research studies, the Institutional Review Board (IRB) and Office for Protection of Research Subjects;
- University and state auditors, and Departments of the university responsible for oversight of research;

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity.

What are the costs for participating in this research?

There are no costs to you for participating in this research.

Will I be reimbursed for any of my expenses or paid for my participation in this research?

You will not be offered payment for being in this study.

Can I withdraw or be removed from the study?

If you decide to participate, you are free to withdraw your consent and discontinue participation at any time.

The Researchers also have the right to stop your participation in this study without your consent if:

→ *They believe it is in your best interests;*
→ *You were to object to any future changes that may be made in the study plan;*

→ *If applicable, list any reasons specific to the study (i.e., the sponsor of the research has decided to stop the research, if you experience a severe side effect, if you do not follow the study procedures or if new information is identified); and/ or*

Who should I contact if I have questions?

Contact the researchers:

Dr. Bill Cope, PhD (Professor, Education Policy, Organization and Leadership), 217-244-4157 or email at billcope@illinois.edu.

- if you have any questions about this study or your part in it,
- if you have questions, concerns or complaints about the research.

David S. Grant, PhD Candidate at 309-224-0727 or email at dsgrant2@illinois.edu.

What are my rights as a research subject?

If you feel you have not been treated according to the descriptions in this form, or if you have any questions about your rights as a research subject, including questions, concerns, complaints, or to offer input, you may call the Office for the Protection of Research Subjects (OPRS) at 217-333-2670 or e-mail OPRS at irb@illinois.edu

Remember:

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University or the organization. If you decide to participate, you are free to withdraw at any time without affecting any relationship to the University or the organization.

I have read (or someone has read to me) the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in this research. I will be given a copy of this signed and dated form.

_____ _____

Signature Date

_____

Printed Name

_____ _____

Signature of Person Obtaining Consent Date (must be same as subject's)

_____

Printed Name of Person Obtaining Consent

APPENDIX B
PILOT STUDY IRB APPROVAL

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Office of the Vice Chancellor for Research

Office for the Protection of Research Subjects
805 W Pennsylvania Ave
Urbana, IL 61801

April 3, 2017

William Cope
Educational Policy Studies
326 Education Bldg
1310 South Sixth Street
Champaign, IL 61820

RE: *The Use of Social Media for Learning and its Effect on Product Nonconformance and Delivery Rates in a Manufacturing Workplace*
IRB Protocol Number: 17133

Dear Dr. Cope:

Thank you very much for forwarding the modifications to the University of Illinois at Urbana-Champaign Institutional Review Board (IRB) office for your project entitled *The Use of Social Media for Learning and its Effect on Product Nonconformance and Delivery Rates in a Manufacturing Workplace.* I will officially note for the record that these minor modifications to the original project, as noted in your correspondence received 03/20/2017, updating study title, eliminating survey and focus group components, removing study of effects of self-efficacy and job satisfaction from protocol, have been approved. The expiration date for this protocol, IRB number 17133, is 10/14/2017. The risk designation applied to your project is *no more than minimal risk.*

As your modifications involved changes to consent form(s), I am attaching the revised form(s) with date-stamp approval. Please note that copies of date-stamped consent forms must be used in obtaining informed consent. If modification of the consent form(s) is needed, please submit the revised consent form(s) for IRB review and approval. Upon approval, a date-stamped copy will be returned to you for your use.

Please note that additional modifications to your project need to be submitted to the IRB for review and approval before the modifications are initiated. To submit modifications to your protocol, please complete the IRB Research Amendment Form (see https://www.oprs.research.illinois.edu/forms-templates/forms/protocol-amendment-form). Unless modifications are made to this project, no further submittals are required to the IRB.

We appreciate your conscientious adherence to the requirements of human subjects research. If you have any questions about the IRB process, or if you need assistance at any time, please feel free to contact me at the OPRS office, or visit our website at https://www.oprs.research.illinois.edu.

Sincerely,

Jennifer Ford, MS
Human Subjects Research Specialist, Office for the Protection of Research Subjects

Attachment(s): Consent form

c: Dave Grant

APPENDIX C
RECRUITMENT E-MAIL

Dear [subject's name]

I am writing to ask if you would agree to participate in a research project entitled "SOCIAL MEDIA FOR LEARNING AND ITS EFFECT ON QUALITY AND DELIVERY IN MANUFACTURING WORKPLACES". The purpose of this study to is examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. Gaps in current available research and the infancy of social media in the workplace leave a great deal of the relationship misunderstood. This research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can aid many organizations in the decision to use social media in their organizations. This research is being conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education Policy, Organization and Leadership in the Graduate College of the University of Illinois at Urbana-Champaign. I hope you will be willing help us with our study.

If you agree to participate, you will be contacted if you are chosen to be used as a part of the study.

At the end of this email is a further explanation of your rights as a subject of research conducted through University of Illinois. Please read the material carefully. By agreeing to participate in the study, it is implied that you have read and understand your rights.

In the meantime, if you have any questions, feel free to call or email me.

Sincerely,

Dave Grant
PhD Candidate
Education Policy, Organization and Leadership
University of Illinois Urbana - Champaign
email: dsgrant2@illinois.edu
phone: 309-224-0727

Additional Information for Research Participants

"SOCIAL MEDIA FOR LEARNING AND ITS EFFECT ON QUALITY AND DELIVERY IN MANUFACTURING WORKPLACES"

(Responsible Investigator: Dr. Bill Cope)

Please read carefully the following information, which explains your rights as a research participant. By agreeing to participate in the study, it is implied that you have read and understand them.

1. You have been asked to participate in a study to examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. There is little research in this area and could offer valuable insights for manufacturing organizations who are considering the use of social learning in their workplaces. This research is being conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education Policy, Organization and Leadership in the Graduate College of the University of Illinois at Urbana-Champaign.

2. You may be asked to participate in this study and will be given further instructions on the needs of the study, if chose to participate.

3. There is no anticipated risk to you from participating in this project. Please note your participation is voluntary and you may decide to leave the study at any time. You may also refuse to answer specific questions you are uncomfortable with. You may withdraw permission for your data to be used, at any time up to 12/31/2017 in which case notes, transcriptions and recordings will be destroyed. Withdrawal or refusal to participate will not affect your relationship with the organization you are employed with or the University of Illinois.

4. There is no anticipated direct benefit to you from participating in this project other than the extent to which you value contributing your knowledge and expertise to understand how social learning in the workplace can help employees do their jobs more effectively and to have an influence in the learning process. You may benefit indirectly from the knowledge gained from the research after it is completed.

5. You will not be compensated in any way for your participation in this research.

6. Questions about this research may be addressed to Dave Grant at 309-224-0727 or Dr. Bill Cope, PhD (Professor, Education Policy, Organization and Leadership), 217-244-4157 or email at billcope@illinois.edu. Questions about a research subjects' rights, or research-related injury may be reported to the University of Illinois at Urbana-Champaign IRB Office at 217.333.2670 or at e-mail irb@illinois.edu.

7. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study.

8. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with the organization or the University of Illinois or with any other participating institutions or agencies.

APPENDIX D
ONLINE ANONYMOUS SURVEY

Social Media in Manufacturing Workplace Survey

Using 1-5 Likert Scale

1-Strongly Disagree
2-Disagree
3-Neutral
4-Agree
5-Strongly Agree

Likert Scale Questions

1. The use of Twitter helped me complete my job on schedule
2. The use of Twitter helped me complete my job with fewer errors
3. The use of Twitter caused distractions in my daily work routine
4. The use of Twitter was valuable for completing my job requirements
5. The use of Twitter has made me more competent in my job performance
6. The use of Twitter showed me that the company wants to help me become better at my job
7. If Twitter is allowed to be used after this study, I am very likely to use it for daily work requirements
8. Before this study, how often did you use Twitter? All the time / Daily / Occasionally on a weekday / Only on weekends / Never

Open Ended Questions

1. What did you like most about the use of Twitter for use in the workplace?
2. What did you like least about the use of Twitter for use in the workplace?
3. How did you change the way you work as a result of the use of Twitter in the workplace?
4. Explain, in detail, how Twitter has affected how you complete your job requirements.
5. Please share any other comments about the use of Twitter in the workplace.

APPENDIX E

RESEARCH STUDY IRB APPROVAL

ILLINOIS
Office for the Protection of Research Subjects

IORG0000014 • FWA #00008584

Notice of Approval: New Submission

May 1, 2018

Principal Investigator	William Cope
CC	Dave Grant
Protocol Title	Social Media in Manufacturing Workplaces
Protocol Number	18746
Funding Source	Unfunded
Review Type	Expedited 5, 7
Status	Active
Risk Determination	No more than minimal risk
Approval Date	05/01/2018
Expiration Date	04/30/2021

This letter authorizes the use of human subjects in the above protocol. The University of Illinois at Urbana-Champaign Institutional Review Board (IRB) has reviewed and approved the research study as described.

The Principal Investigator of this study is reponsible for:

- Conducting research in a manner consistent with the requirements of the University and federal regulations found at 45 CFR 46.
- Requesting approval from the IRB prior to implementing modifications.
- Notifying OPRS of any problems involving human subjects, including unanticipated events, participant complaints, or protocol deviations.
- Notifying OPRS of the completion of the study.

Office for the Protection of Research Subjects
University of Illinois at Urbana-Champaign
(217) 333-2670
irb@illinois.edu

APPENDIX F

RESEARCH STUDY RECRUITMENT E-MAIL

Dear [subject's name]

I am writing to ask if you would agree to participate in a research project entitled "SOCIAL MEDIA IN MANUFACTURING WORKPLACES". The purpose of this study to is examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. Gaps in current available research and the infancy of social media in the workplace leave a great deal of the relationship misunderstood. This research can address potential needs of an organization to reduce costs and to remain viable in a very competitive global market. The results from this research can aid many organizations in the decision to use social media in their organizations. This research is being conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education Policy, Organization and Leadership in the Graduate College of the University of Illinois at Urbana-Champaign. I hope you will be willing help us with our study.

If you agree to participate, you will be contacted if you are chosen to be used as a part of the study.

At the end of this email is a further explanation of your rights as a subject of research conducted through University of Illinois. Please read the material carefully. By agreeing to participate in the study, it is implied that you have read and understand your rights.

In the meantime, if you have any questions, feel free to call or email me.

Sincerely,

Dave Grant
PhD Candidate
Education Policy, Organization and Leadership
University of Illinois Urbana - Champaign
email: dsgrant2@illinois.edu
phone: 309-224-0727

Additional Information for Research Participants

"SOCIAL MEDIA IN MANUFACTUING WORKPLACES"

(Responsible Investigator: Dave Grant)

Please read carefully the following information, which explains your rights as a research participant. By agreeing to participate in the study, it is implied that you have read and understand them.

1. You have been asked to participate in a study to examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in the workplace and the effects on quality metrics in terms of nonconformances and delivery rates. There is little research in this area and could offer valuable insights for those manufacturing organizations who are considering the use of social learning in their workplaces. This research is being conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education Policy, Organization and Leadership in the Graduate College of the University of Illinois at Urbana-Champaign.

2. You may be asked to participate in this study and will be given further instructions on the needs of the study, if chose to participate.

3. There is no anticipated risk to you from participating in this project. Please note your participation is voluntary and you may decide to leave the study at any time. You may also refuse to answer specific questions you are uncomfortable with. You may withdraw permission for your data to be used, at any time up to 12/31/2018 in which case notes, transcriptions and recordings will be destroyed. Withdrawal or refusal to participate will not affect your relationship with the organization you are employed with or the University of Illinois.

4. There is no anticipated direct benefit to you from participating in this project other than the extent to which you value contributing your knowledge and expertise to understand how social learning in the workplace can help employees do their jobs more effectively and to have an influence in the learning process. You may benefit indirectly from the knowledge gained from the research after it is completed.

5. You will not be compensated in any way for your participation in this research.

6. Questions about this research may be addressed to Dave Grant at 309-224-0727 or Dr. Bill Cope, PhD (Professor, Education Policy, Organization and Leadership), 217-244-4157 or email at billcope@illinois.edu. Questions about a research subjects' rights, or research-related injury may be reported to the University of Illinois at Urbana-Champaign IRB Office at 217.333.2670 or at e-mail irb@illinois.edu.

7. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to “not participate” in the study.

8. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with the organization or the University of Illinois or with any other participating institutions or agencies.

Please keep a copy of this email for your own records.

APPENDIX G

RESEARCH STUDY CONSENT FORM

SOCIAL BEHAVIORAL RESEARCH CONSENT FORM
Research Information and Consent for Participation in Social Behavioral Research

SOCIAL MEDIA IN MANUFACTURING WORKPLACES

You are being asked to participate in a research study. Researchers are required to provide a consent form such as this one to tell you about the research, to explain that taking part is voluntary, to describe the risks and benefits of participation, and to help you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Principal Investigator Name and Title: Dr. Willam Cope, PhD
Department and Institution: EPOL, College of Education, University of Illinois – Urbana-Champaign

Address and Contact Information:
326 Education Building
1310 S. Sixth St.
Champaign, IL 61820
217-244-4157

Why am I being asked?

You are being asked to be a subject in a research study about a relationship between the implementation of social learning and quality metrics (including rejection rates and on time delivery and the use of social media for learning in a manufacturing workplace. There is little research in this area and could offer valuable insights for those manufacturing organizations who are considering the use of social learning in their workplaces.

You have been asked to participate in the research because you are an employee of a business unit within the organization where the research is taking place. There is absolutely no risk to the relationship with your employers by your decision to participate or not participate in this research.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with the University of Illinois at Urbana-Champaign. **If you decide to participate, you are free to withdraw at any time without affecting that relationship.**

Approximately 100 subjects may be involved in this research through UIUC.

What is the purpose of this research?

The purpose of this study to is examine of there is a relationship between the use of social media for learning in the workplace and understanding the relationships between the implementation and use of social learning in a manufacturing workplace and the effects on quality metrics in terms of

continuing in the research. If new information is provided to you, your consent to continue participating in this research may be re-obtained.

Are there benefits to taking part in the research?

You may not directly benefit from participation in the research but your help in the research can help further changes to the workplace that could affect you and other employees.

What other options are there?

You have the option to not participate in this study

Will my study-related information be kept confidential?
Yes, but not always. In general, we will not tell anyone any information about you. When this research is discussed or published, no one will know that you were in the study. However, laws and university rules might require us to disclose information about you. For example, if required by laws or University Policy, study information which identifies you and the consent form signed by you may be seen or copied by the following people or groups:

- The university committee and office that reviews and approves research studies, the Institutional Review Board (IRB) and Office for Protection of Research Subjects;
- University and state auditors, and Departments of the university responsible for oversight of research;

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity.

What are the costs for participating in this research?

There are no costs to you for participating in this research.

Will I be reimbursed for any of my expenses or paid for my participation in this research?

You will not be offered payment for being in this study.

Can I withdraw or be removed from the study?

If you decide to participate, you are free to withdraw your consent and discontinue participation at any time.

The Researchers also have the right to stop your participation in this study without your consent if:

→ *They believe it is in your best interests;*

→ *You were to object to any future changes that may be made in the study plan;*

→ *If applicable, list any reasons specific to the study (i.e., the sponsor of the research has decided to stop the research, if you experience a severe side effect, if you do not follow the study procedures or if new information is identified); and/ or*

Who should I contact if I have questions?

Contact the researchers:
Dr. Bill Cope, PhD (Professor, Education Policy, Organization and Leadership), 217-244-4157 or email at billcope@illinois.edu.

- if you have any questions about this study or your part in it,
- if you have questions, concerns or complaints about the research.

David S. Grant, PhD Candidate at 309-224-0727 or email at dsgrant2@illinois.edu.

What are my rights as a research subject?

If you feel you have not been treated according to the descriptions in this form, or if you have any questions about your rights as a research subject, including questions, concerns, complaints, or to offer input, you may call the Office for the Protection of Research Subjects (OPRS) at 217-333-2670 or e-mail OPRS at irb@illinois.edu

Remember:

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University or the organization. If you decide to participate, you are free to withdraw at any time without affecting any relationship to the University or the organization.

I have read (or someone has read to me) the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in this research. I will be given a copy of this signed and dated form.

_____ _____

Signature Date

_____

Printed Name

_____ _____

Signature of Person Obtaining Consent Date (must be same as subject's)

_____

Printed Name of Person Obtaining Consent

APPENDIX H

OPEN ENEDED SURVEY RESPONSES

Open Ended Question 1 (Survey Question 9)

Social Media in Manufacturing Workplace Survey

What did you like most about the use of Twitter for use in the workplace?

Answered	**48**
Skipped	**0**

Respondents	Response Date	Responses
1	Aug 13 2018 03:10 PM	Easy to use
2	Aug 13 2018 03:11 PM	Convenient
3	Aug 13 2018 03:11 PM	Right on my phone
4	Aug 13 2018 03:12 PM	Easy
5	Aug 13 2018 04:02 PM	Got information quickly
6	Aug 13 2018 04:03 PM	Felt like the others were helping me
7	Aug 13 2018 04:15 PM	Easy to use
8	Aug 13 2018 04:22 PM	Convenient
9	Aug 13 2018 04:25 PM	Easy
10	Aug 13 2018 04:49 PM	Easy
11	Aug 13 2018 07:14 PM	Much needed support
12	Aug 13 2018 11:01 PM	Good communication
13	Aug 14 2018 07:10 AM	Instantaneous help
14	Aug 14 2018 08:04 AM	Easy
15	Aug 14 2018 09:41 AM	Easy to use
16	Aug 14 2018 10:22 AM	On my phone
17	Aug 14 2018 10:25 AM	Quick
18	Aug 14 2018 01:37 PM	Easy to use
19	Aug 14 2018 02:14 PM	Convenient
20	Aug 14 2018 02:36 PM	Right on my phone
21	Aug 14 2018 02:48 PM	Easy
22	Aug 14 2018 02:53 PM	Got information quickly
23	Aug 14 2018 03:24 PM	Easy
24	Aug 14 2018 04:11 PM	Easy to use
25	Aug 14 2018 05:47 PM	Convenient
26	Aug 14 2018 07:10 PM	Easy to communicate
27	Aug 14 2018 07:13 PM	Easy
28	Aug 14 2018 07:21 PM	Much needed support
29	Aug 14 2018 09:15 PM	Good communication
30	Aug 14 2018 10:02 PM	Instantaneous help
31	Aug 14 2018 10:28 PM	Help seemed to be right there
32	Aug 14 2018 11:19 PM	Easy to use
33	Aug 15 2018 02:14 AM	Could reach others for help easily
34	Aug 15 2018 01:13 PM	Quick
35	Aug 15 2018 02:14 PM	Easy
36	Aug 16 2018 02:16 PM	Easy
37	Aug 16 2018 02:54 PM	Not sure
38	Aug 16 2018 03:28 PM	Team worked well together with this
39	Aug 16 2018 05:14 PM	Easy to use
40	Aug 17 2018 01:17 AM	Convenient
41	Aug 17 2018 03:45 AM	Right on my phone
42	Aug 17 2018 05:45 AM	Easy
43	Aug 17 2018 09:43 AM	Got information quickly
44	Aug 17 2018 02:42 PM	Easy
45	Aug 17 2018 03:29 PM	I didn't feel alone
46	Aug 17 2018 05:20 PM	Help was always there
47	Aug 17 2018 06:16 PM	Easy
48	Aug 17 2018 07:21 PM	Convenient

Figure H1

Open Ended Question 2 (Survey Question 10)

Social Media in Manufacturing Workplace Survey

What did you like least about the use of Twitter for use in the workplace?

Answered	**48**
Skipped	**0**

Respondents	Response Date	Responses
1	Aug 13 2018 03:10 PM	Felt like I needed to check my phone all of the time
2	Aug 13 2018 03:11 PM	Big Brother watching
3	Aug 13 2018 03:11 PM	Distraction
4	Aug 13 2018 03:12 PM	I felt tied down to the phone
5	Aug 13 2018 04:02 PM	Distraction
6	Aug 13 2018 04:03 PM	Lots of BS going on all of the time
7	Aug 13 2018 04:15 PM	Yak, yak, yak
8	Aug 13 2018 04:22 PM	Phone died every day
9	Aug 13 2018 04:25 PM	Felt like I was on the phone all of the time
10	Aug 13 2018 04:49 PM	Distraction
11	Aug 13 2018 07:14 PM	No one seemed to try without asking for help
12	Aug 13 2018 11:01 PM	Distraction
13	Aug 14 2018 07:10 AM	Lots of extra chatting taking place
14	Aug 14 2018 08:04 AM	Crutch
15	Aug 14 2018 09:41 AM	Too easy. No one learned anything
16	Aug 14 2018 10:22 AM	Don't know
17	Aug 14 2018 10:25 AM	Distraction
18	Aug 14 2018 01:37 PM	I felt tied down to the phone
19	Aug 14 2018 02:14 PM	Distraction
20	Aug 14 2018 02:36 PM	I don't know
21	Aug 14 2018 02:48 PM	Phone is too easy to use
22	Aug 14 2018 02:53 PM	Distraction
23	Aug 14 2018 03:24 PM	No one learned how to do their jobs
24	Aug 14 2018 04:11 PM	Many used after we were off work
25	Aug 14 2018 05:47 PM	Distraction
26	Aug 14 2018 07:10 PM	Phone died all of the time
27	Aug 14 2018 07:13 PM	Something else might have been better
28	Aug 14 2018 07:21 PM	Distraction
29	Aug 14 2018 09:15 PM	Added to my work load
30	Aug 14 2018 10:02 PM	I was always watching the phone
31	Aug 14 2018 10:28 PM	Too easy.
32	Aug 14 2018 11:19 PM	I don't know
33	Aug 15 2018 02:14 AM	I worked harder with the thing than without
34	Aug 15 2018 01:13 PM	I dunno
35	Aug 15 2018 02:14 PM	I was always on the phone. Boss hated that fact
36	Aug 16 2018 02:16 PM	Even on my lunch, I got messages
37	Aug 16 2018 02:54 PM	Challenging to use without losing my mind
38	Aug 16 2018 03:28 PM	Distraction
39	Aug 16 2018 05:14 PM	Excuse to not do real work
40	Aug 17 2018 01:17 AM	Dumbest crap I have ever had to work with
41	Aug 17 2018 03:45 AM	None of the others ever tried to learn their jobs
42	Aug 17 2018 05:45 AM	Distraction to say the least
43	Aug 17 2018 09:43 AM	Had to keep my phone charged WAY more
44	Aug 17 2018 02:42 PM	Distraction
45	Aug 17 2018 03:29 PM	Glad I have unlimited data
46	Aug 17 2018 05:20 PM	Pain in the butt
47	Aug 17 2018 06:16 PM	Distraction to everyone
48	Aug 17 2018 07:21 PM	Killed my battery twice a day

Figure H2

Open Ended Question 3 (Survey Question 11)

Social Media in Manufacturing Workplace Survey

How did you change the way you work as a result of the use of Twitter in the workplace?

Answered	**48**
Skipped	**0**

Respondents	Response Date	Responses
1	Aug 13 2018 03:10 PM	Relied on phone more than looking for other people
2	Aug 13 2018 03:11 PM	Faster to get instructions
3	Aug 13 2018 03:11 PM	Avoided the phone as much as possible
4	Aug 13 2018 03:12 PM	Reached out to others when needed
5	Aug 13 2018 04:02 PM	Help was only a Tweet away
6	Aug 13 2018 04:03 PM	I know others are there to help
7	Aug 13 2018 04:15 PM	I tweet to ask for help when I need it
8	Aug 13 2018 04:22 PM	Not sure
9	Aug 13 2018 04:25 PM	None. I hated that thing
10	Aug 13 2018 04:49 PM	I can ask for help easier now
11	Aug 13 2018 07:14 PM	I learned my job better thanks to the help I got
12	Aug 13 2018 11:01 PM	I don't know
13	Aug 14 2018 07:10 AM	Not sure
14	Aug 14 2018 08:04 AM	None
15	Aug 14 2018 09:41 AM	None
16	Aug 14 2018 10:22 AM	Don't know
17	Aug 14 2018 10:25 AM	I ask for help and get it
18	Aug 14 2018 01:37 PM	I know FAST help is there if needed
19	Aug 14 2018 02:14 PM	I use the phone for answers in other ways, too
20	Aug 14 2018 02:36 PM	I don’t know
21	Aug 14 2018 02:48 PM	I was able to get help easily
22	Aug 14 2018 02:53 PM	I learned more about the equipment I was working on
23	Aug 14 2018 03:24 PM	I use Twitter all of the time now, even when I am not at work
24	Aug 14 2018 04:11 PM	No comment
25	Aug 14 2018 05:47 PM	I ask for help easier now
26	Aug 14 2018 07:10 PM	I help others the same way I learned using Twitter
27	Aug 14 2018 07:13 PM	None
28	Aug 14 2018 07:21 PM	Twitter is an anchor for me to use for help
29	Aug 14 2018 09:15 PM	I can ask for help and get it
30	Aug 14 2018 10:02 PM	I don’t have to leave my cell to ask for help
31	Aug 14 2018 10:28 PM	None
32	Aug 14 2018 11:19 PM	It is easier to get help now that I can ask for it from 20 other people
33	Aug 15 2018 02:14 AM	Help is right around the corner
34	Aug 15 2018 01:13 PM	No comment
35	Aug 15 2018 02:14 PM	I ask for help without reservation now
36	Aug 16 2018 02:16 PM	I am much faster at my job since I learned so much
37	Aug 16 2018 02:54 PM	I think I do my job better… I don't know.
38	Aug 16 2018 03:28 PM	None
39	Aug 16 2018 05:14 PM	I can get the help I need
40	Aug 17 2018 01:17 AM	I learned a great deal about technology and the stuff I work on
41	Aug 17 2018 03:45 AM	I like working with everyone. They seem to want to help
42	Aug 17 2018 05:45 AM	I ask for help all of the time and get it very quick
43	Aug 17 2018 09:43 AM	I can get help from a bunch of people not just one or two
44	Aug 17 2018 02:42 PM	None
45	Aug 17 2018 03:29 PM	I get help easier now
46	Aug 17 2018 05:20 PM	I know my job better because of it
47	Aug 17 2018 06:16 PM	I get my job done faster noe
48	Aug 17 2018 07:21 PM	I don't know

Figure H3

Open Ended Question 4 (Survey Question 12)

Social Media in Manufacturing Workplace Survey

Explain, in detail, how Twitter affected how you completed your job requirements.

Answered	**48**
Skipped	**0**

Respondents	Response Date	Responses
1	Aug 13 2018 03:10 PM	It has allowed me to know that I can reach out to others when needed
2	Aug 13 2018 03:11 PM	During the 90 trial, I was able to learn a number of the units that I may not have been able to learn without it
3	Aug 13 2018 03:11 PM	It made me more confident
4	Aug 13 2018 03:12 PM	I feel like I am better prepared to do my job
5	Aug 13 2018 04:02 PM	I'm better at my job
6	Aug 13 2018 04:03 PM	The team communicates better now
7	Aug 13 2018 04:15 PM	I learned more using Twitter
8	Aug 13 2018 04:22 PM	I am faster at doing my job and than helps!
9	Aug 13 2018 04:25 PM	I can communicate with the others easier
10	Aug 13 2018 04:49 PM	I was trained in a way that made it more fun
11	Aug 13 2018 07:14 PM	I can get help easier now
12	Aug 13 2018 11:01 PM	I can do my job with confidence
13	Aug 14 2018 07:10 AM	We seem to communicate beter as a whole
14	Aug 14 2018 08:04 AM	It makes the whole process more fun
15	Aug 14 2018 09:41 AM	I wasted a lot of time helping others
16	Aug 14 2018 10:22 AM	We all communicate better now
17	Aug 14 2018 10:25 AM	I feel like I know the others better now
18	Aug 14 2018 01:37 PM	I do my job better
19	Aug 14 2018 02:14 PM	Help is much easier to get now
20	Aug 14 2018 02:36 PM	I learned A LOT
21	Aug 14 2018 02:48 PM	We seem to work better together
22	Aug 14 2018 02:53 PM	Everyone is now on a big team instead of a bunch of individuals
23	Aug 14 2018 03:24 PM	I learned many more units and can do them faster
24	Aug 14 2018 04:11 PM	I know my coworkers better now
25	Aug 14 2018 05:47 PM	I can work faster now
26	Aug 14 2018 07:10 PM	I have the help I need when I need it
27	Aug 14 2018 07:13 PM	Waste of time
28	Aug 14 2018 07:21 PM	It didn't. It seemed like I worked harder with it
29	Aug 14 2018 09:15 PM	I have more confidence in my job
30	Aug 14 2018 10:02 PM	It slowed me down
31	Aug 14 2018 10:28 PM	I can get help when I need it
32	Aug 14 2018 11:19 PM	I think I do my job better now
33	Aug 15 2018 02:14 AM	I am better at my job.
34	Aug 15 2018 01:13 PM	I have confidence in what I am doing in all of the cells
35	Aug 15 2018 02:14 PM	It made me faster at completing the calibrations
36	Aug 16 2018 02:16 PM	I liked using Twitter because it made us all communicate better and faster
37	Aug 16 2018 02:54 PM	I like knowing I can ask for help very quickly rather than wonder around looking for someone
38	Aug 16 2018 03:28 PM	We work more as a team now
39	Aug 16 2018 05:14 PM	I ask for help and get an answer from more than one place quickly
40	Aug 17 2018 01:17 AM	I learned how to do my job better
41	Aug 17 2018 03:45 AM	I can do my job better and I know I can do it better now than before
42	Aug 17 2018 05:45 AM	Nothing
43	Aug 17 2018 09:43 AM	We all want to help one another… mostly
44	Aug 17 2018 02:42 PM	I can do my job in a faster and more confident way
45	Aug 17 2018 03:29 PM	We can communicate with even those who are not at work
46	Aug 17 2018 05:20 PM	I can get help when I ask for it
47	Aug 17 2018 06:16 PM	I do my job better and faster
48	Aug 17 2018 07:21 PM	I thought it helped us all work better together

Figure H4

Open Ended Question 5 (Survey Question 13)

Social Media in Manufacturing Workplace Survey

Please share any other comments about the use of Twitter in the workplace.

Answered	**10**
Skipped	**38**

Respondents	Response Date	Responses
1	Aug 13 2018 03:10 PM	I liked using it a great deal
2	Aug 13 2018 03:11 PM	
3	Aug 13 2018 03:11 PM	I like Twitter but maybe we can try something else to see how it works?
4	Aug 13 2018 03:12 PM	
5	Aug 13 2018 04:02 PM	
6	Aug 13 2018 04:03 PM	
7	Aug 13 2018 04:15 PM	
8	Aug 13 2018 04:22 PM	
9	Aug 13 2018 04:25 PM	
10	Aug 13 2018 04:49 PM	I think the whole team likes using this!
11	Aug 13 2018 07:14 PM	
12	Aug 13 2018 11:01 PM	
13	Aug 14 2018 07:10 AM	
14	Aug 14 2018 08:04 AM	
15	Aug 14 2018 09:41 AM	
16	Aug 14 2018 10:22 AM	
17	Aug 14 2018 10:25 AM	
18	Aug 14 2018 01:37 PM	
19	Aug 14 2018 02:14 PM	
20	Aug 14 2018 02:36 PM	I hope we can use this all of the time
21	Aug 14 2018 02:48 PM	
22	Aug 14 2018 02:53 PM	
23	Aug 14 2018 03:24 PM	
24	Aug 14 2018 04:11 PM	
25	Aug 14 2018 05:47 PM	I had never used Twitter before. I like what it has done for me and the team.
26	Aug 14 2018 07:10 PM	
27	Aug 14 2018 07:13 PM	
28	Aug 14 2018 07:21 PM	
29	Aug 14 2018 09:15 PM	
30	Aug 14 2018 10:02 PM	Can we PLEASE get rid of this?
31	Aug 14 2018 10:28 PM	
32	Aug 14 2018 11:19 PM	This college thing weas a LOT of fun!
33	Aug 15 2018 02:14 AM	
34	Aug 15 2018 01:13 PM	
35	Aug 15 2018 02:14 PM	
36	Aug 16 2018 02:16 PM	I am much better now that we used this!
37	Aug 16 2018 02:54 PM	
38	Aug 16 2018 03:28 PM	
39	Aug 16 2018 05:14 PM	
40	Aug 17 2018 01:17 AM	
41	Aug 17 2018 03:45 AM	
42	Aug 17 2018 05:45 AM	STUPID
43	Aug 17 2018 09:43 AM	Most of us really like using this. I hope it continues!
44	Aug 17 2018 02:42 PM	
45	Aug 17 2018 03:29 PM	
46	Aug 17 2018 05:20 PM	
47	Aug 17 2018 06:16 PM	
48	Aug 17 2018 07:21 PM	

Figure H5

APPENDIX I

WORD CLOUDS

Open Ended Question 1 (Survey Question 9)

Figure I1

Open Ended Question 2 (Survey Question 10)

Figure I2

Open Ended Question 3 (Survey Question 11)

Figure I3

Open Ended Question 4 (Survey Question 12)

Figure I4

Open Ended Question 5 (Survey Question 13)

Figure I5

APPENDIX J

HIERARCHY TABLES

Open Ended Question 1 (Survey Question 9)

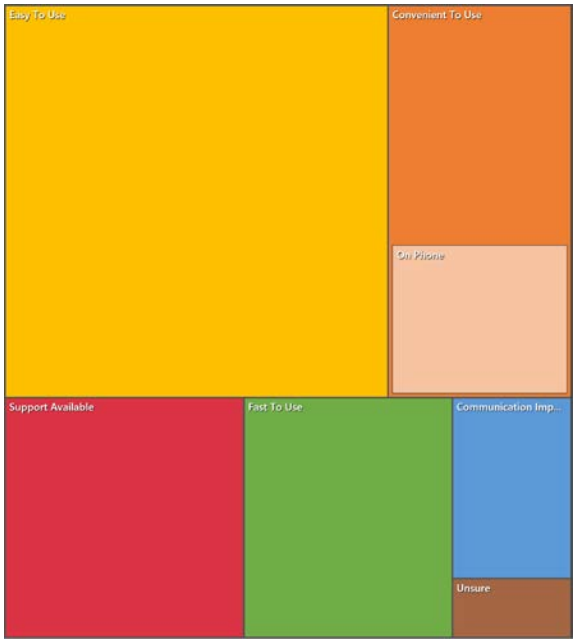

Figure J1

Open Ended Question 2 (Survey Question 10)

Figure J2

Open Ended Question 3 (Survey Question 11)

Figure J3

Open Ended Question 4 (Survey Question 12)

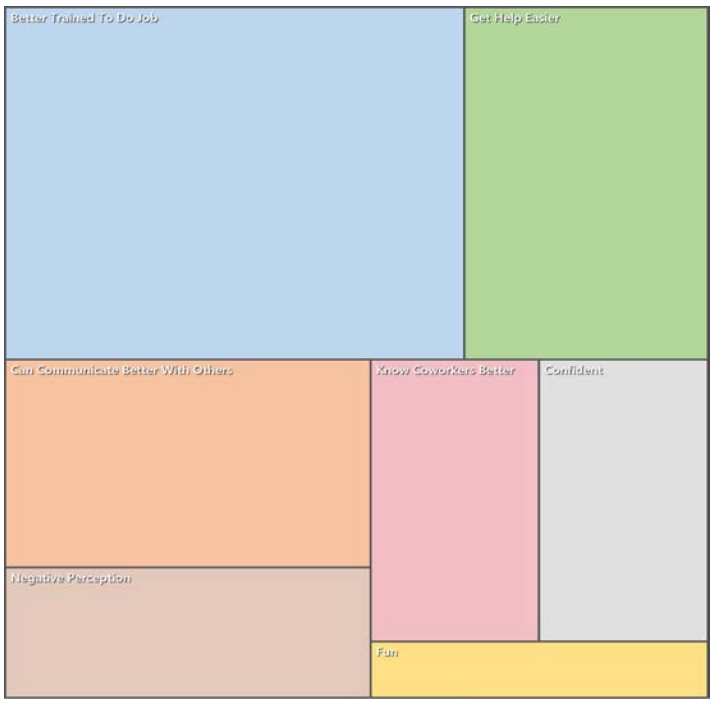

Figure J4

Open Ended Question 5 (Survey Question 13)

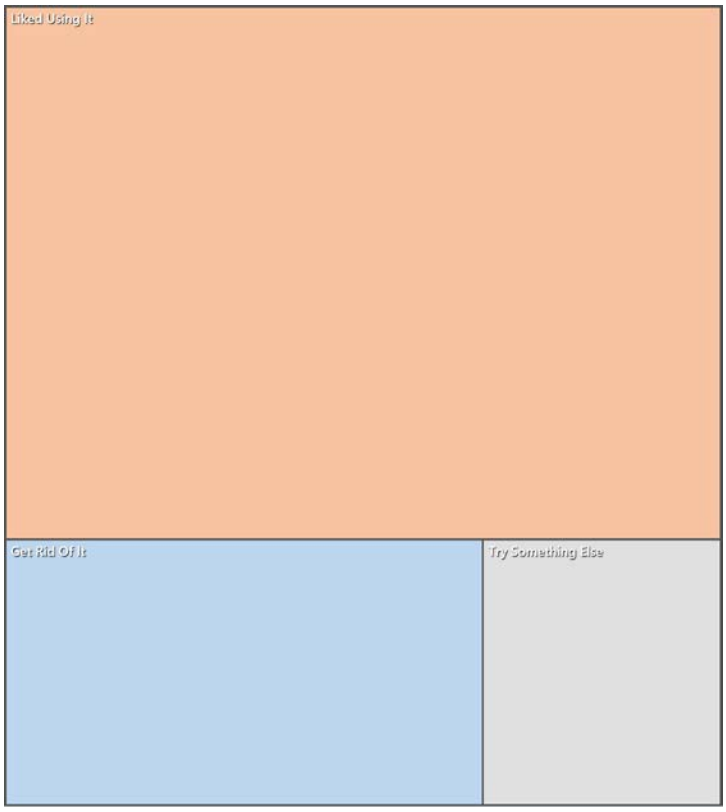

Figure J5