A CASE STUDY ANALYSIS OF THE EFFECTS OF SIX SIGMA MENTORING ON PROJECT SUCCESS

by

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ABSTRACT

This study is an embedded single-case study doctoral dissertation with a mixed methods design using a qualitative and quantitative pretested instrument to collect data to explore how mentoring affects project success at an organization in Duncan, South Carolina. The embedded units are the subgroup associated with the three levels of Six Sigma expertise, champions, project leaders, and team members. The results conclude that mentoring has a positive impact on project success, and the more effective the mentoring the more project success experienced by the team member. Mentoring has a similar effect on all members of a project team including team sponsors, team leaders, and team members.
DEDICATION

This dissertation is dedicated all my mentors of past and present: My mother Rita Denomme, who is and has always been my role model; Fred Wallace who encouraged me to pursue higher education; Joe Ficalora who introduced me to Six Sigma and provided the motivational example to become a Master Blackbelt; and Dr. Richard Schuttler for reminding me that “life happens” and I should not let life prevent me from achieving my goals.
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CHAPTER 1: INTRODUCTION

One’s capabilities are expanded through mentoring (Haggis, 1997; Lehr, 1987; Nielson, 1998; Parise, 2005; Potts, 2002). According to Crosby (1979), “The most effective way to bring operating and other management people to their senses is to put them in contact with someone they believe” (p. 49). Crosby realized the importance of having mentors in the workplace to provide quality managerial leadership (Dailey, 2002; Stromei, 1998). The role of professional managers is to guide and instruct the executive management with the mentoring facet of their job (Crosby). Leaders should have an appreciation for the responsibility of passing experience to the next generation of leaders as an important aspect of doing their job thus expanding the capabilities of the entire population in the organization, individually and collectively (Bossidy & Charan, 2002; O’Daniel, 2005).

Organizational transformation requires that strong united leaders and mentors provide the wisdom to transform the organization (Kisti, 2000; Rudnitsky, 2003; Schmidt, 1997; Schneider, 2003). Six Sigma is defined as an initiative in which companies strive for significant financial advantage through continuous improvement using data-driven decisions (Leathers, 2002). Mentors are important in Six Sigma programs. They are leaders who teach, coach, and mentor project leaders and project teams (Breyfogle, 2003). Thomas Pyzdek (2003), a leading Six Sigma consultant, described mentors in organizations as individuals with extensive wisdom about the way organizations work and who can, as a result, see interrelationships that may not be apparent to others. Mentors help guide change and avoid pitfalls and obstacles that would
otherwise be barriers to success (Hairston, 2004; Lutz-Ritzheimer, 2005). Mentors also provide strategic options for accomplishing goals effectively (Pyzdek).

This embedded single-case study used a mixed methods design with multiple units of analysis (Yin, 2003) to validate the relationship between Six Sigma mentoring and project success. In this study, the embedded units are the subgroups associated with the three levels of Six Sigma expertise known as champions, project leaders, and team members. The success of the mentoring process as a function of quality programs implemented to direct organizational effectiveness could be more clearly and specifically presented in the available literature. This study provided new knowledge about mentoring roles and the effectiveness of a Six Sigma quality program. The results of this study could impact leaders who are planning to explore Six Sigma. This study might also affect the way Six Sigma organizational leaders approach the mentoring aspect of the Six Sigma culture by offering suggestions for making improvement initiatives more effective through the use of mentors in the workplace. Leaders of organizations looking to refine their current quality programs for increased opportunities through continuous process improvement could also find this study valuable.

Background of the Problem

Throughout history, mentors have influenced leaders, athletes, students, and other learners toward success by means of formal mentor programs (Hernandez, 2001). Mentors are paired with younger people to accelerate the learning process of individuals with lesser expertise and quickly raise their level of skill to that of the mentor. Athletic organizations have formal mentor programs to ensure the success of individuals composing the entire organization (Alleyne, 2003; Hernandez). Numerous studies
regarding the effectiveness of mentor programs in educational settings have shown that mentoring has a positive effect on accelerated learning and behavior (Alleyne; Burrus, 2003; Cohen, 2005; Curtis, 2005; Pickard, 2003; Propst, 2003; Simcox Myers, 2003; Tracey, 2003). Mentorship programs in organizational settings provide guidance and coaching to newer employees to assist acclimatization into their new environment and to teach them skills and knowledge related to the job (Chadd, 2003; Kirkman & Shapiro, 1997; Post, 2002; Rudnitsky, 2003; Sutton, 2000; Wang, 2001).

Educators use mentor programs as a training mechanism to raise the level of knowledge, awareness, and expertise of beginners to that of the knowledgeable and skilled mentors thus reaching a universal level of excellence (Chadd, 2003; Lyon, 2003; Rudnitsky, 2003; Sutton, 2000). For example, Post (2002) reported on New York’s educational outreach program that the Nonprofit ACE Mentor Program is “dedicated to aiding an industry critically short on talent by guiding inner-city high school students toward careers in architecture, construction and engineering” (p. 1). According to Joiner, Bartram, and Garreffa (2004), mentoring has two main benefits in the professional and academic worlds: “First, mentoring is an effective career development and management-training tool for employees; secondly, mentoring offers a number of organizational benefits such as retention of quality employees, effective succession planning and increased organizational commitment” (pp. 168-169). Although the benefits of mentorship are evident and mentoring is shown to be an integral part of individual success in education (Chadd; Lyon; Rudnitsky; Sutton), manufacturers have yet to embrace the concept as a tool for project success (Breyfogle, 2003). This research study examined Six Sigma as a modern formal organizational mentor program and validated
the need to expand this body of knowledge with regard to the influence of mentoring on project success.

The literature search of available sources provided limited results. There appears to be a lack of research material on modern applications of industry-leveraged mentor programs. In the history of the United States, there was a time when formal mentor programs were part of the fabric of industry (Evans, 2000). Inexperienced workers would be trained through apprenticeships, decreasing the time needed for their learning curve and transforming the knowledge of veteran employees to the learning employees. Advancement was based on individual performance and sponsorship by the trainer, ensuring that only the trained and skilled employees would advance.

The near elimination of mentors in industry has been attributed to collective bargaining of trade unions and mass production (Evans, 2000; Sawchuk, 2003). The historical perspectives of mentorship in industries of the past revealed the positive effects mentoring can have on organizations. Organizational leaders can gain insight from the historical mentor programs of knowledge transfer techniques and learn that opportunities exist to strengthen industries by the application of productive mentor programs in today’s organizations.

Mentors are important in Six Sigma programs where the martial arts belt metaphor signifies the level of applied statistical expertise in project management and process improvement. Mentors can access the highest level of expertise in the Six Sigma methodologies with the title of master black belt. Individuals at this level teach, coach, and mentor the lower level black belts, green belts, and yellow belts (Breyfogle, 2003).
These top educators in Six Sigma are mentors and coaches for project leaders and project teams (Belbin, 2004; Guttman, 2004; Holden, 2002; Tenner & DeToro, 1997).

Some leaders of manufacturing organizations such as General Electric, Motorola, and Allied Signal embraced the formal mentor program and developed a mentor model for project management, process improvement, and cost reduction (Breyfogle, 2003; Harry & Schroeder, 2000; Pande, Neuman, & Cavanaugh, 2000; Thomerson, 2002; Value Based Management, 2004). Regarding execution of a strategic initiative, Bossidy and Charan (2002) stated, “The discipline of execution doesn’t work unless people are schooled in it and practice it constantly” (p. 30). These companies attribute much of their success to the execution of Six Sigma as a culture because Six Sigma raised the level of expertise within the organization and provided each company substantial cost savings (Breyfogle; Harry & Schroeder; Pande et al.).

Mentors of Six Sigma could be used as models for success for various industries. Mentors help individuals reach their life’s goals through enhancing self-esteem and motivating new interest in work and projects. According to Joiner et al. (2004), the benefits of mentoring included not only an inexpensive solution to “proactively influence employee attitudes and perceptions, but also reduce employee turnover within the organization” (p. 169). It was the objective of this study to examine the value of Six Sigma as a formal mentor program and model for industry and to add to the present body of knowledge.

Statement of the Problem

Since the introduction of mass production and collective bargaining, there has been a decrease in mentor relationships in the manufacturing environment (Evans, 2000).
Organizations where the knowledge base belongs to a few experienced individuals could have unskilled employees if no program exists to transfer that knowledge before the experienced individuals exit the organization. As a result of new employees not being paired with the more knowledgeable staff, the expert knowledge might not be transferred to the new employees as efficiently as it was in the industrial revolution when new employees were matched with veteran employees in an apprentice relationship (Alleyne, 2003; Hernandez, 2001).

Mentoring has a positive effect on individual performance (Evans, 2002; Haggis, 1997; Lehr, 1987; Nielson, 1998; Parise, 2005; Potts, 2002). The first developers of Six Sigma designed the program with a mentoring component to guide individual and team achievements (Belbin, 2004; Breyfogle, 2003; Pyzdek, 2003). Most organizations use Six Sigma to improve project success using project management to achieve cost reductions, but they do not leverage the mentoring component of Six Sigma (Breyfogle; Pyzdek).

The mentoring component is underutilized by organizations using Six Sigma and this underutilization has organizational costs (Bahr, 2004; Kincaid, 2004; Newton & Wilkinson, 1993). Organizations with Six Sigma programs that do not leverage individual and team mentoring might not be as successful as those using this leverage. The return on investment for Six Sigma programs might be greater if mentoring is leveraged (Bahr; Kincaid; Newton & Wilkinson). The embedded single-case mixed methods design was utilized to explore the relationship between mentoring and project success. The Six Sigma program participants at a South Carolina order fulfillment facility constituted the population for this study.
Purpose of the Study

The purpose of this embedded single-case study using a mixed methods design was to explore the influence of mentoring on the success of Six Sigma projects conducted in a supply chain and fulfillment business in the southeastern region of the United States. Multiple data collection methods used to enhance, validate, corroborate, or refute the data included surveys, interviews data, and a desk study of the project notebooks. The embedded single-case study using a mixed methods design was used to conduct research at a single organization including more than one unit of analysis (Yin, 2003).

In this study, the embedded units were the subgroups associated with the three levels of Six Sigma expertise known as champions, project leaders, and team members. The embedded single-case study design was feasible for this research study because this specific Six Sigma case at the host organization was representative of other organizations with Six Sigma programs. From this exploration of Six Sigma mentoring, a list of factors were produced that could enhance future Six Sigma project success. The study explored the influence of the independent variable, mentoring, on the dependent variable, project success, for all the members of the Six Sigma teams who participated on five Six Sigma projects conducted at the organization where this study took place.

Significance of the Study to Leadership

This research study added to the existing body of related literature by expanding on mentoring as a success factor of quality programs used to drive organizational effectiveness. This study was important because it exposed the relationship that mentors have with project teams and examined project success that was attributed to the relationship between mentors and project leaders. This study added to the modern
theories of leadership that evolved from early process-focused quality programs including Six Sigma, Lean Manufacturing, and Lean Sigma (Bossert, 2003; Breyfogle, 2003; George, 2003; Pyzdek, 2003). By exposing the effects of mentoring on project leaders, organizational leaders can make greater use of the cultural improvement programs that have coaches, team leaders, and project teams. By expanding the use of mentoring, organizational leaders can better focus on cultural change, organizational improvement, cost-effectiveness, and process efficiencies (Gupta, 2003; Henderson & Evans, 2000; Kotter, 1996; Valentin-Zeitz, 1996).

The research produced worthwhile information in three distinctive ways. First, this study added to the Six Sigma field of study by providing data from observations of the effects of Six Sigma mentoring on organizations and projects in which the soft skills of leaders and the human side of leading change are as important as the technical skills for effective change (Bass, 1990; Katz, 2004; Kotter, 1996; Pyzdek, 2003). Second, this study expanded the body of leadership knowledge by providing a theory on how mentoring affects project success. Limited information was available about Six Sigma and the effects of collective mentoring in the workplace, but a wealth of knowledge exists regarding implementation of Six Sigma for leading cost savings initiatives (Breyfogle, 2003; George, 2002; Harry & Schroeder, 2000; Pande et al., 2000; Pyzdek). Third, the findings from this study provided worthwhile data for those planning to explore Six Sigma or who are looking to refine their current quality programs for increased opportunities through continuous process improvement. People who are coached and mentored become better leaders and have a greater opportunity to make an impact on
other people and processes (Bahr, 2004; Bass; Bossidy, & Charan, 2002; Katz; Kincaid, 2004; Kotter; Pyzdek).

Nature of the Study

The study incorporated a mixed methods approach to data collection with the embedded single-case study design (Yin, 2003). Three participating groups were studied to compare their experiences with Six Sigma mentoring. The subgroups in the study were interviewed for their unique perspectives on the relationship of Six Sigma mentoring to organizational success. Multiple data collection methods were used to enhance, validate, corroborate, or refute emerging findings through collection from three groups of participants (Delich, 2004; Welch, 2004).

Cross-referencing the questions using both quantitative and qualitative inquiry methods increased the validity of the results thereby enhancing confidence in the findings (Denzin, 1970; Foreman, 1948; Mathison, 1988; Merriam, 1998). Two types of methods were used to collect and analyze the research results thus forming a truer portrayal of the effectiveness of mentoring on the participants’ project success. This design was appropriate because it provided data about the mentors’ ability to transfer knowledge about tasks to mentees.

First, data were collected from various participants in the research study (Denzin, 1970; Maggs-Rapport, 2000). Data were collected from three different participating groups, champions (sponsors), project leaders (black belts and green belts), and team members (yellow belts). Each participating category provided a different perspective of the mentor relationship. The data obtained from the three groups of participants were used to validate, corroborate, or refute the emerging findings.
The second form of data comparison consisted of a combination of quantitative and qualitative data collection (Denzin, 1970; Maggs-Rapport, 2000). The questionnaire was developed and was used to collect quantitative data while qualitative data were collected through one-on-one interviews with the participants. Equal weight was placed on the quantitative and qualitative data as equal sources of research information (Denzin, 1970; Foreman, 1948). The quantitative portion of this study employed the questionnaire constructed with a Likert-type scale to collect data from the research study participants and obtain their view of project success as a result of their relationship with their Six Sigma mentor. The qualitative portion consisted of interviews with the same participants on the same topics. The quantitative and qualitative methods overlapped in design to validate the results through triangulation. The results of the two data collection methods were used to support or dispute the results (Denzin; Foreman).

The population participants observed in this research study were employees of a small to mid-size company and all were Six Sigma program participants. The participants were asked several questions about the effectiveness of mentoring for the Six Sigma projects in which they participated. They were also asked to compare them with other projects they participated in that did not have the mentoring aspect of Six Sigma. Questions about the effectiveness of mentoring for the Six Sigma projects versus other projects without the mentoring aspect of Six Sigma allowed for a view into the effectiveness of Six Sigma mentoring within the organization, which was the main purpose of this research study.

The survey population providing the unit of analysis is a supply chain and order fulfillment operation located in Duncan, South Carolina. The data relationships between
the independent variable, Six Sigma mentoring, and the dependent variable, project success were discovered. The three participating groups, Six Sigma champions, project leaders, and project teams completed a quantitative questionnaire based on the research questions. Participants also engaged in a qualitative interview with questions that were triangulated with the quantitative questions. The triangulation technique was also used in the data analysis to enhance the validity of the research results by merging and comparing the themes emerging from the quantitative data with the qualitative data and discussing how they supported or refuted the statistical analysis of the data (Denzin, 1970; Foreman, 1948).

Research Questions

Based on past research regarding the effects of mentoring on project success, this single-case study contributed to current theories by answering the following two research questions about the overall effectiveness of Six Sigma mentoring and the differences in the effects of mentoring on the participating subgroups:

R1. How does Six Sigma mentoring affect project success in a Six Sigma organization?

R2. How does the effectiveness of mentoring on project success differ for champions, project leaders, and team members?

Successful implementation of change initiatives requires strong leadership coupled with the softer social skills for execution and sustainability (Bass, 1990; Katz, 2004; Kotter, 1996; Pyzdek, 2003). There is evidence that organizational efficacy is correlated with motivation, speed, adaptability, and flexibility (Breyfogle, 2003; LaRue, Childs, & Larson, 2004; Pyzdek). Regardless of how organizational leaders strategize the
implementation of new initiatives, the human side of motivation is needed for execution (Bossidy & Charan, 2002; Kotter; Maslow, 1954; Pyzdek). The role of mentors is to understand the way organizations work in order to see hidden relationships, help the change agents avoid barriers, and provide a map for accomplishing tasks effectively (Pyzdek).

Six Sigma project leaders navigate the change they are leading while master black belts or black belts oversee their efforts (Brewer & Eighme, 2005). Master black belts or black belts assist project leaders to overcome organizational barriers (Hahn, Hill, Hoerl, & Zinkgraf, 1999). It seemed reasonable to assume that Six Sigma project leaders function better and obtain better results in organizations with the guidance of personal mentors (Hahn et al.). On a larger scale, with many people being mentored as in a Six Sigma program, project success would be promoted (Hayes, 2005). Project leaders with no mentor might be less effective in change execution, and on a larger scale with no one being mentored, success might be minimized (Stevens & Frazer, 2005). Since mentoring is an influential factor in individual success, it was important to analyze the relationship between mentoring and project success.

All project leaders had varying ability for project management based on past project management experience and formal education. The difference in abilities among participants was an intervening variable that could not be easily controlled. This intervening variable could impact the study results therefore it needed to be controlled through statistical tests and was included in the design (Sproull, 2004). Difference in ability was measured with questions for the participants to disclose prior project management experience and level of education. The relationships between experience
and education and the effects of mentoring were measured by testing the correlations among the constructs.

This study explored the relationship between mentoring and project success. Organizational leaders can measure success in terms of the business metrics that have the greatest impact on top management such as quality costs as they relate to sales, profits, shares of common stock, cost of goods sold, total manufacturing costs, and the break-even point (Gupta, 2003; Juran & Gryna, 1993). Organizational leaders might not recognize a relationship between mentoring and project success. The first research question asked how Six Sigma mentoring affects project success in a Six Sigma organization. Understanding the effectiveness of mentoring on project success adds to the body of knowledge in the field of leadership by contributing new data on the effect that mentoring has on Six Sigma projects’ success. The participants were asked how effective mentoring was to their project results. Questions relating to the effectiveness of mentoring were used to measure their ability to achieve project goals on schedule.

The second observation in this study was the relationship between mentoring and the different levels of Six Sigma participants. Organizations are complex and confusing, and oftentimes project leaders do not know where to go or whom to ask to overcome a barrier. Pyzdek (2003) recognized the role of the mentor as one who understands the organization and directs project leaders so they can quickly progress and navigate through barriers, accelerating team productivity. Pyzdek explained,

The mentor can help guide the project manager through the maze by clarifying lines of authority. At the same time, the mentor’s senior position enables him to
see the implications of complexity and to work to eliminate unnecessary rules and procedures. (p. 564)

The second research question asked how the effectiveness of mentoring on project success differs for the three subgroups. The research study compared the effectiveness of mentoring on project success for the three subgroups by obtaining data from the three different levels of Six Sigma participants. These results added to the body of knowledge in leadership literature about the effect that mentoring has on different levels of project teams, champions, team leaders, and team members.

Conceptual Framework

Primary concepts regarding the variables of this study supported the conceptual framework of the research. The concept of mentoring and the effects that mentoring has on protégés were discussed. Project success was also examined to understand the conceptual framework in relation to the independent variable of mentoring. The concept of project success includes more than measuring how well an organization compares to a set standard. The importance of Six Sigma for management theory is also important to understand. Additional research is needed to understand the influential relationship that mentors have on project success.

Mentoring is paternalistic in nature, providing the protégé with a role model to follow, and providing confirmation and acceptance in the organization (Levinson, Darrow, Klein, Levinson, & McKee, 1978). Protégés benefit from their mentor’s knowledge, experience, and status, and the mentoring relationship gives them sponsorship and an increased visibility with management, possibly translating to a promotional advantage (Johnson, 1980). As a result, protégés have career opportunities,
potential to earn higher pay, job security, and recognition in the organization (Johnson; Roche, 1979). Mentoring tends to encourage protégés to cooperate in joint team efforts in the organization, contributing to project success (Fiedler & Leister, 1977; Hunt & Michael, 1983). Mentors personally and professionally benefit and experience advancement as a result of the protégés’ success (Jennings, 1967). Mentors accumulate power, success, and peer respect (Kram, 1980). Mentors also gain access to information, both inside and outside the organization, furthering their influence on the organizational culture (Kram; Levinson et al.).

Understanding the concept of project success is not as easy as measuring how well an organization compares to a set standard. Juran and Gryna (1993), Wren (1994), Scott (2003), and Thompson (2003) described several criteria for measuring the success of an organization. Herman, Renz, and Heimovics (1997) argued that, historically, project success is the result of metric modifications made to the organizational goal model. Yuchtman and Seashore (1967) regarded project success as the ability to use the environment to acquire resources, including acquisitions and financial resources as measures of efficacy. Organizational leaders can measure project success in terms of the business metrics that have the greatest impact on top management, which is quality costs relating to sales, profits, shares of common stock, costs of goods sold, total manufacturing costs, and the break-even point (Gupta, 2003; Juran & Gryna).

The quality movement focused organizational leaders on defining success as it relates to customers’ definition of quality (Scott, 2003). Organizational leaders seek to measure their efficiency through visible improvements (Thompson, 2003). Project success for a company poses new challenges in the arena of global business including
multi-cultural, economic, and political agendas (Wren, 1994). Through different views, they all agreed that the measurement of project success is necessary for understanding how an organization measures up to the criteria leading to operational excellence.

A component of the conceptual framework was the importance of Six Sigma to management theory. Six Sigma is grounded in the management theoretical constructs of Taylor’s (1911) scientific management theory. “Taylor and his followers insisted that it was possible to analyze tasks performed by individual workers scientifically in order to discover those procedures that would produce the maximum output with the minimal input of energies and resources” (Scott, 2003, p. 34). Gilbreth and Gilbreth (1917) elaborated on Taylor’s scientific management theory and performed time and motion studies to improve productivity and efficiencies. The same scientific management concepts are applied today to Six Sigma type organizational cultures. Based on previous studies, additional research was needed to understand the influential relationship that mentors have on project success. The study observed this relationship in a Six Sigma type organizational culture from the perspectives of three subgroups.

**Definition of Terms**

This section lists the terms used in the research to establish a common vocabulary for the purpose of this study.

*Black Belt (BB).* A black belt is a technical project team leader with expertise in using the Six Sigma methodology and statistical analysis techniques for process improvement. Black belts are a full-time resource dedicated to the Six Sigma initiative (Breyfogle, 2003; Pyzdek, 2003).
**Green Belt (GB).** A green belt is a project leader and/or process expert trained in the use the Six Sigma methodology but weaker in the statistical analysis techniques for process improvement. Green belts are a part-time resource dedicating approximately 30% of their time toward Six Sigma initiatives, and they integrate Six Sigma into their daily job duties (Breyfogle, 2003; Pyzdek, 2003).

**Host organization.** The organization where the research study took place is a division of a German privately held global organization. The host organization’s global headquarters are in Brussels, Belgium, with the North America Headquarters in Valencia, California, extending to the East Coast regional headquarters in Duncan, South Carolina. The host organization is a supply chain and fulfillment business that supports its clients with high quality logistics and customer fulfillment solutions in customer care relations, fulfillment, offset printing, on-demand production, and supply chain management (Arvato Services, n.d.).

**Master Black Belt (MBB).** A master black belt has the highest level of expertise in the Six Sigma methodologies. Individuals at this level teach, coach, and mentor the lower-level black belts, green belts, and yellow belts. These top educators in Six Sigma are mentors and coaches for the project leaders and project teams (Breyfogle, 2003; Pyzdek, 2003).

**Mentor.** A mentor is a person who can teach, coach, and guide the development of a novice in a profession or organization. Mentoring is a nurturing process that aids in the development of a protégé (Evans, 2002).
**Participant.** People who have had an active role in a Six Sigma program, including champions, team leaders, and team members. Participant is also used for people who participated in this research study.

**Project Success.** Project success is based on the accomplishment of the project objectives. Project leaders, in conjunction with their project champion, determine the project success factors. The project success factors are quantitative measures determined by the organizational leaders and project participants (Coronado & Antony, 2002; Voelkel, 2005), and they are documented in the project charter.

**Six Sigma Champion.** A Six Sigma Champion is a trained leader and process owner. Some champions also participate in the Six Sigma Steering Committee. Their role as Champion is to select Six Sigma projects, assign project leaders and teams, align resources, remove barriers, and review Six Sigma projects at Phase Reviews (Breyfogle, 2003; Pyzdek, 2003).

**Six Sigma Steering Committee.** The Six Sigma Steering Committee is the guiding coalition that addresses the infrastructure issues and resource allocations that enable a Six Sigma organizational culture to flourish (Breyfogle, 2003).

**Six Sigma Team.** A Six Sigma team is a group of diverse individuals all contributing to the expertise necessary to improve a process. Six Sigma Teams consist of one black belt or green belt as team leader and several green belts and/or yellow belts as data collectors and experts on subject matter and process (Breyfogle, 2003; Pyzdek, 2003).

**Six Sigma.** Six Sigma is a robust statistical measurement of a process, symbolized by the Greek letter σ, which represents a process capability with a normal data
distribution having exactly 3.4 defects per million opportunities. It is also defined as an
initiative where companies strive for significant financial advantage through continuous
improvement using data-driven decisions (Leathers, 2002).

*Yellow Belt (YB).* A yellow belt is a data collector and team member on a process
improvement project team. Yellow belts are the members of the process improvement
teams led by black belts or green belts. They are subject matter experts in the process that
the project is to improve and are assigned by the champion at team formation (Breyfogle,
2003).

**Assumptions**

This study was based on the following underlying assumptions regarding the
attributes of a Six Sigma master black belt. The first assumption was that the master
black belt at the host organization had developed the necessary communication,
coaching, teaching skills, and Six Sigma program management expertise to be an
effective Six Sigma leader (Pyzdek, 2003; Scott, 2003). The second assumption relates to
attitudes defined as emotions that reflect responses within the organization (Pyzdek). The
second assumption was that the participants in the Six Sigma program studied have
positive attitudes toward the Six Sigma program. The basis for the second assumption
was that the general population in the organization studied favorably accepted the Six
Sigma culture. Six Sigma is a cultural change and requires a new set of knowledge, skills,
and abilities among participants. The change itself could have a negative impact on
someone’s attitude, and this negative impact could have been reflected in the study
results (Kotter, 1996).
Limitations

Limitations to the research study were examined in order to take into account potential limits to the interpretation and applicability of the study results. The validity of this study was limited to the reliability of the survey instrument and of the interview questions used to examine the relationship of the Six Sigma mentor on the success of the project. Additionally, there may be potential limits to the interpretation of the study results for organizations that greatly differ from the host organization in size, maturity, and business type. The next sections discuss these limitations in detail.

The questionnaire was developed and pretested. The inquiry into the different project team experiences of the participants was limited to the actual team experiences of each individual. Some participants had participated in several non-Six Sigma project teams while others had only participated in Six Sigma teams. Participants were asked to differentiate their experiences on project teams without a mentor from their experience on Six Sigma project teams that had formal mentoring relationships. With the questionnaire, the experiences were compared for each participant on project teams, and their role on project teams was compared to their experiences on Six Sigma teams that included mentoring. It is still possible that the questions were not formulated as accurately as they could have been in order to elicit the most reliable data.

Limits to the interpretation of the study results might exist due to the relatively small size of the host organization, the young maturity level of the Six Sigma culture studied, and the specific application of mentoring in an order fulfillment business. The study results might be more applicable to organizations of a similar size and location to the host organization such as small to mid-size companies located in small southern
towns and practicing Six Sigma. The study results might not be as applicable to larger organizations due to differences in the depth and breath of Six Sigma implementation. Organizations with an older maturity level in their Six Sigma culture might find it easier to implement the findings from this study because they have a larger pool of resources available to them. Organizations whose type of business greatly differs from the customer-focused order fulfillment business at the host organization might have difficulties in the application of mentoring throughout the organization. Organizations that do not focus on customer expectations and requirements might not adapt as easily to the mentoring structure recommended in this research study.

Delimitations

Delimitations to the research study consisted of the specific participants’ profile and the characteristics of the chosen research design. The program participants were chosen for specific characteristics that made them ideal sources of data for this study with a focus on the relationship of Six Sigma mentoring to project success. The participants were project team members in the Six Sigma program at the supply chain and fulfillment business located in Duncan, South Carolina. The participants were able to reflect on their mentoring experiences while participating on a Six Sigma team. Only voluntary Six Sigma program participants were included. This study was limited to the number of participants surveyed and the time allotted for conducting the interviews and surveys. The study took place exclusively at the business located in Duncan, South Carolina.

The embedded single-case study with a mixed methods design included multiple units of analysis (Yin, 2003) and explored the influence of mentoring on project success. The specific research design choice addressed the intended scope of the study and
allowed validation of the data gathered by triangulating the data using both quantitative and qualitative methods for three sub-groups. The specific research design allowed a valid comparison of the participants’ reflective experiences with multiple data collection methods. No other design would have fulfilled the goals of the study.

Scope of the Study

The embedded single-case study using a mixed methods design used multiple units of analysis (Yin, 2003) and explored the influence of mentoring on project success. The study population included all voluntary Six Sigma participants in the program at the supply chain and fulfillment business located in Duncan, South Carolina. Critical success factors for project management include management support, project schedule plans, impacted parties, personnel, training, mentor relationship, technical tasks, monitoring, feedback, communication, team leader characteristics, organizational politics, environmental events, and urgency associated with the project (Coronado & Antony, 2002; Pinto & Slevin, 1989). These factors were kept constant by including the teams of only one wave of Six Sigma projects. All participants in each subgroup had been subjected to the same management team, project timeline, organization, and personnel pool for team members. Only the relationship of the Six Sigma mentors to the participants’ experience in the program was examined. The study was an exploration of the impact of a mentoring relationship on the participants’ experience, and the data revealed the kind of impact that mentoring had on the team’s project success. Varying participants’ abilities were an intervening variable that was controlled by including questions for the participants to disclose whether they had prior project management experience and indicate their level of education.
Summary

This chapter presented the research study, defined how the study examined Six Sigma as a modern formal organizational mentor program, and identified why it was important to expand the knowledge of Six Sigma mentoring with regard to project success. This study explored the effects of mentoring on project success in a Six Sigma organization and the differing effects mentoring had on three subgroups. A goal of this embedded single-case study was to validate the results using a pretested survey instrument and conduct interviews in order to examine the effectiveness of Six Sigma mentoring on project success for Six Sigma project teams in the host organization (Yin, 2003). The analyzed data were used to develop a theory on the effectiveness of mentoring on Six Sigma project success for team members of varying levels, champions, project leaders, and team members (LeCompte, Preissle, & Tesch, 1993).

The results of the study are important to the practice of Six Sigma and the leadership field of study by providing sound data about the influence of mentoring on project success (Breyfogle, 2003; Coronado & Antony, 2002; Pyzdek, 2003). The goal of this study was to provide new knowledge on Six Sigma as it relates to mentoring in the workplace (Alleyne, 2003; Billett, 2003; Hernandez, 2001). The results of this study have the potential to provide important data for those planning to explore Six Sigma or who are looking to refine their current quality programs for increased opportunities through continuous process improvement.

Chapter 2 presents the review of the literature that relates to the independent variable, Six Sigma mentoring, and the dependent variable, project success, by understanding the effect mentoring has on project success. The breadth of literature
regarding the independent and dependent variables and a synopsis of the study context are presented. Chapter 3 is a detailed review of the research methodology and the instruments that were used to conduct the survey and interviews. Chapter 4 presents a discussion of the data collection process and data analysis results. Chapter 5 presents a larger meaning about the data analysis and includes an interpretation of the data results and implications for the study of leadership.
CHAPTER 2: REVIEW OF THE LITERATURE

Many manufacturing organizations are experiencing challenges associated with unskilled workers (Hiltrop, Jenster, & Martens, 2001; Nelson, 2002). At the start of the industrial revolution, new employees were paired with veteran employees in an apprentice relationship in which the veterans taught the new employees the skills and tools of their trade thus passing on the trade to a younger skilled workforce (Alleyne, 2003; Hernandez, 2001). Advancement and pay increases of the apprentices were based on the recommendation of their mentors. Since the introduction of mass production and collective bargaining of employee trade unions, there has been a decrease in mentor relationships in the manufacturing environment (Evans, 2000; Sawchuk, 2003). When new employees are not being paired with the more knowledgeable staff, expert knowledge is not transferred to the new employees as efficiently as it was in the industrial revolution when new employees were matched with veteran employees in an apprentice relationship (Alleyne; Hernandez).

Chapter 1 provided an overview of the research study and described the problem of organizations that do not get the return on investment that they could achieve if they invested in the practice of formal mentoring. The purpose of this embedded single-case study (Yin, 2003) was discussed as a means to support or refute the hypothesis that Six Sigma mentoring could positively impact project success. This study explored three hierarchical groups of Six Sigma participants who provided their views of how mentoring influenced project success in a company located in the southeastern region of the United States.
Chapter 2 provides a review of the existing literature and identifies areas where additional research is warranted. The literature review focuses on the independent variable, Six Sigma mentoring, and the dependent variable, project success, by examining the effect mentoring has on project success. The breadth of literature regarding the independent and dependent variables is described. The literary sources consulted included peer-reviewed journals, dissertations, resource books, and periodicals available on the Internet and at various university libraries. A review of the supply chain and fulfillment business was included. A mid-size company located in Duncan, South Carolina was the setting for the study. The literature examined suggested that Six Sigma as a mentor program and the relationship mentoring has on project success have not been researched. The literature was also lacking in studies of mentoring in small to mid-size companies practicing Six Sigma and located in small southern towns. The intent of the research was in part to add to the current body of literature about mentoring and its effect on project success.

Documentation

The sources for this literature review included research-based peer-reviewed journals and dissertations located in the University of Phoenix online library databases ProQuest, EBSCO, ProQuest Digital Dissertations, ERIC, and PsycINFO. Other search engines used were www.Economist.com for business articles and www.2Facts.com for world news information. Resource books and periodicals from various university libraries and Internet sites were also used in this literature review. The available literature was analyzed to understand and define the historical significance of Six Sigma and mentor programs. The authors of the references selected were evaluated for their level of
expertise on the topics of interest. The research in the scholarly review regarding the dependent and independent variables consisted of research-based peer-reviewed journals, dissertations, conference proceedings, and germinal and contemporary books. Table 1 is a synopsis of the sources used in this literature review.

Table 1

Synopsis of Sources in the Literature Review

<table>
<thead>
<tr>
<th>Reference Type</th>
<th>Total</th>
<th>Less than 5 years</th>
<th>Greater than 5 years</th>
<th>n.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research-based peer reviewed journals</td>
<td>20</td>
<td>6</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Dissertations</td>
<td>14</td>
<td>10</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Conference proceedings</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Germinal and contemporary books</td>
<td>24</td>
<td>11</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Websites</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Literature Review

In the literature review, the identification and application of Sigma mentoring is examined. Another focus was the relationship of Six Sigma mentoring to success in manufacturing organizations in the United States when leaders implement Six Sigma as a cost control mechanism and do not recognize the program’s importance for its mentoring influence on project success. This review of Six Sigma as a mentoring program included sources identified in the literature, the definition of Six Sigma mentoring, and its relationship to the context of the research study. This literature review included alternative views of Six Sigma and exposed a gap in the literature regarding the impact of mentoring on project success.
To find scholarly research for the independent variable Six Sigma mentoring, several databases were searched with different terms for Six Sigma and mentoring. Terms used to search Six Sigma mentoring included Six Sigma and related terms such as statistical process control, lean sigma, lean manufacturing, total quality management, and the names of the originators of these methodologies in quality in manufacturing including W. Edward Deming, Joseph M. Juran, Walter A. Shewhart, and Philip B. Crosby. Terms for the word mentor were used to conduct the literature search and included mentor, adviser, counselor, guide, tutor, teacher, guru, coach, trainer, and consultant. Using these terms allowed for an exhaustive literature research.

Independent Variable - Six Sigma Mentoring

Definition of Six Sigma. Six Sigma is defined by Leathers (2002) as a metric, an initiative, and a philosophy. As a metric, Six Sigma is a robust statistical measurement of a process symbolized by the Greek letter $\sigma$ that represents process capability with a normal data distribution, having exactly 3.4 defects per million opportunities. It is defined as an initiative taken by leaders of companies who strive for significant financial advantage through continuous improvement.

As a philosophy, Six Sigma is a means to achieve data-driven decisions. Six Sigma terminologies originate from the relationship between process variations and customer specifications (Breyfogle, 2003; George, 2003; Pyzdek, 2003). Six Sigma is also identified as “a framework for linking improvements to profitability” (Gupta, 2003, p. 12). In the context of this study, a Six Sigma program at the host organization was used to represent the project management programs at other similar organizations.
**History of Six Sigma.** The Six Sigma methodology has evolved from scientific management and various continuous improvement theories by combining the finest elements of many former quality initiatives (Folaron & Morgan, 2003). Building on the management and organization theory of the early 1900s developed and presented by Henri Fayol, Frederick Taylor examined management efficiency and systemization, and the exploration of these concepts led to scientific management theories.

In 1913, Henry Ford developed the assembly line. Frank Gilbreth and his wife Lillian Gilbreth further developed the study of efficiency as it applied to manufacturing (Wren, 1994). In 1925, Walter Shewhart introduced the process control chart as a manufacturing data collection technique, which later became statistical quality control (Wheeler & Chambers, 1992). With the end of World War II in 1945, Japan was forced to decrease weapon production, and it started using its factories for the production of consumer goods. In 1954, in the post war efforts, Juran and Deming helped incorporate quality initiatives into Japan’s manufacturing culture. For the next 20 years, the quality of Japanese products was considered superior to the quality of other countries’ manufactured products. Compared to the manufacturing capabilities in the United States, Japanese manufacturing was considered more effective (Breyfogle, 2003).

The International Organization for Standardization (ISO) developed the series of ISO 9000 standards in 1987. The ISO standards were accepted as the criteria for quality management systems. The United States government introduced the performance excellence standards known as the Malcolm Baldrige National Quality Award in 1987. The national quality award is given annually to the top companies for recognition of excellent quality management, and it is presented by the President of the United States to
organizations that meet the criteria for business excellence (Cianfrani, Tsiakals, & West, 2002).

In 1988, Motorola was the first company awarded the Baldrige Award, and as a winner, the organization shared the metric-based, customer-focused quality program know as the Six Sigma methodology and the MAIC steps to measure, analyze, improve and control organizational processes. Eventually, the process was modified by other organizations. A D for define was later added as the first step to the methodology (DMAIC) for clear problem definition and location of resources for projects (Breyfogle, 2003). Allied Signal, IBM, and General Electric adopted Six Sigma for strategic and tactical operations. After hearing about Six Sigma in 1995, the CEO of General Electric, Jack Welch, made it a corporate requirement and condition for employment as well as a requirement for conducting business with suppliers. It was through the application of Six Sigma methodologies that Welsh was credited for the GE success and inflated market value (Value Based Management, 2004).

History of mentors. Mentoring is a powerful way for people to thrive and learn a variety of personal and professional skills (Zachary, 2000). Mentoring is considered one of the oldest forms of influence that one person can have on another. The literature attributes the origin of the term mentoring to the ancient Greek storyteller Homer. In his classic tale The Odyssey, the King of Ithaca, before leaving to fight in the Trojan War, looks to his friend Mentor to protect his son Telemachus while he is away (Peer Systems Consulting Group, 2003). Homer’s Mentor was a protective, guiding, and supportive figure who acted as a wise and trusted counselor to Telemachus (Roberts, 1999). The literature also suggests that mentors were commonplace in Africa and Asia long before
the ancient Greek civilization (Peer Systems Consulting Group; AKKA Karate USA, n.d.).

*Mentors in the workplace.* The literature search on mentors and mentoring resulted in material describing the frequent use of mentoring in educational and athletic contexts and in association with project success. Effective mentor programs in the workplace require mentors who show an interest in the employees they mentor, match skills with the job functions, enable learning experiences, and have an educational environment conducive to learning (Billett, 2003; Chadd, 2003; Johnson, 1980).

Mentoring is defined as a “process whereby a seasoned successful individual takes a young inexperienced individual under their wing and shows them the ropes” (Johnson & Bergmann, 1988, p. 19). Mentors serve as teachers, coaches, and guides in the development of a novice in a profession or organization (Paulus & Nijstad, 2003). Mentoring is a nurturing process that aids in the development of a protégé (Evans, 2002; Levinson et al., 1978).

Mentoring benefits the mentor, the protégé, and the organization. Mentoring is paternalistic in nature, providing the protégé with a role model, and providing confirmation and acceptance within the organizational culture (Levinson et al., 1978; Paulus & Nijstad, 2003). Protégés benefit from their mentor’s knowledge, experience, and status, and the mentoring relationship gives them sponsorship and an increased visibility for management, possibly translating to a promotional advantage (Johnson, 1980; Johnson & Bergmann, 1988; Paulus & Nijstad). As a result, protégés have more career opportunities, potential to earn higher pay, job security, and recognition in the organization (Johnson; Paulus & Nijstad; Roche, 1979).
A study conducted by Bouquillon (2004) revealed that “protégés with supervisory mentors reported higher levels of compensation than protégés with non-supervisory mentors” (p. iii). Mentoring has a tendency to encourage protégés to cooperate in team efforts in the organization, contributing to project success (Fiedler & Leister, 1977; Hunt & Michael, 1983). In addition, mentors personally and professionally benefit and experience advancement as a result of the developing protégés’ success (Jennings, 1967). Mentors accumulate power, success, and peer respect (Kram, 1980). Mentors also gain access to information both inside and outside the organization, furthering their influence (Kram; Levinson et al., 1978). In the context of the study, the mentoring aspect of Six Sigma was studied to understand whether the benefits of mentoring are evident in the participants and in their projects.

Six Sigma is structured as a formal mentor program that uses the martial arts’ belt analogy to structure the organizational culture into a hierarchy of process management expertise with the purpose of project execution. The master black belt (MBB) is the teacher and advisor; the champion is the coach; the black belt (BB) is the technical project leader; the green belt (GB) is a project leader and process expert; and yellow belt (YB) is a data collector and team member (Breyfogle, 2003; Eckes, 2003). The Six Sigma training program for each hierarchical level is designed to prepare individuals for their role in a process improvement team. The levels of expertise act as a support structure for the project teams (Pyzdek, 2003). Figure 1 provides a diagram of the Six Sigma organizational hierarchy used by organizations employing Six Sigma as their culture.
Figure 1. Six Sigma hierarchical structure and mentor relationships.

Note. Figure 1 was created for the purpose of this research study to display the relationships between the participants on a Six Sigma project team.

Six Sigma as a mentor program. In the context of the research study, Six Sigma was examined as a mentor program that influences project success. The levels of expertise, master black belt, champion, black belt, green belt, and yellow belt were examined to understand the effectiveness of mentoring on project success for each subgroup.

Based on the information on the independent variable, Six Sigma mentoring, provided in the literature review, the effectiveness of mentoring was examined on Six Sigma projects by identifying the effectiveness of mentoring on:

1. Understanding the Six Sigma process management steps of Define, Measure, Analyze, Improve, and Control (DMAIC).

2. Applying the DMAIC process.

3. Following the DMAIC project plan.
4. Understanding the link between improvement and profitability.
5. Showing an interest in the employee.
6. Matching skills with the job functions.
7. Enabling the learning experiences.
8. Having an educational environment conducive to learning.
9. Guiding the development of the novice in project management.
10. Nurturing process that aids in the development of the protégé.
11. Benefiting the mentor, protégé, and the organization.
12. Having a paternalistic nature in providing the protégé with a role model.
13. Providing confirmation and acceptance within the organizational culture.
14. Having protégés benefit from their mentors’ knowledge, experience, and status.
15. Giving the sponsorship and increased visibility to management, possibly translating to a promotional advantage.
16. Providing more career opportunities.
17. Providing the potential to earn higher pay.
18. Providing increased job security.
19. Providing recognition in the organization.
20. Encouraging protégés to cooperate in joint team efforts in the organization.
21. Contributing to project success.
22. Having mentors personally and professionally benefiting and experiencing advancement as a result of the protégés’ success.
23. Having mentors accumulate power, success, and peer respect.
24. Having mentors gain access to information, both inside and outside the organization, thus furthering their influence.

25. Having evidence of benefits of mentoring in the individuals and projects.

26. Preparing individuals for their role on a process improvement team.

27. Having the levels of expertise act as a support structure for the project teams.

As a mentor program, Six Sigma is mentioned in the literature but not specifically discussed. The various roles in a Six Sigma organization are defined as responsibilities. Mentors are referred to as experts who offer assistance on projects, remove barriers, and critically review projects (Breyfogle, 2003; George, 2003; Gupta, 2003). The literature most often addresses culture change in organizations in the context of profitability and cost savings.

The term guru is used to define “the quality expert who is looked up to for their vast knowledge and leadership on the subject” (Phillips-Donaldson, 2004, p. 6). Six Sigma leaders are also mentioned as role models and transformational leaders who have influence on top management, cross-functional teams, and self-managed work teams (Crosby, 1979; Hamamoto, 2002). The next section summarizes the results of the literature search on Six Sigma mentoring, the independent variable in this research proposal. The subsequent section reports on the findings in the literature regarding project success, the dependent variable in this study.

**Dependent Variable - Project Success**

This literature review addresses the relationship between the independent variable, Six Sigma mentoring, and the dependent variable, project success. It includes the identification and application of both variables as well as the relationship between
them. Scholarly sources concerning project success are reviewed in this section. Project success was found to be clearly defined in the literature, including in relationship to the significance it has to the context of this study. This section explores multiple perspectives regarding project success, and it compares and contrasts viewpoints. A historical perspective is used to define the scope of the literature on project success, put in evidence the gaps in the literature, and draw conclusions.

The relationship between project success and Six Sigma mentors was studied in peer-reviewed articles and germinal books. Table 2 is a synopsis of the literature review of the dependent variable, project success.

Table 2

Synopsis of Literature Review of the Independent and Dependent Variables

<table>
<thead>
<tr>
<th>Topic of Examination</th>
<th>Total</th>
<th>Peer-reviewed</th>
<th>Dissertations</th>
<th>Books</th>
<th>Websites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six Sigma defined</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>History of Six Sigma</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>History of mentors</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mentors in the workplace</td>
<td>17</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Six Sigma as a mentor program</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>History of project success</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Project success defined</td>
<td>14</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
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<tr>
<td>Project success to Six Sigma mentor</td>
<td>40</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Not all the literature reviewed is cited in Table 2.
When searching by keyword, combination searches for Six Sigma and mentor often produced no results. This indicates a potential gap exists in the literature. Project success was examined using germinal books by Crosby (1979), Deming (1986), Juran (1974), Juran and Gryna (1993), Wren (1994), Scott (2003), Thompson (2003), and several other contemporary authors on the topic of Six Sigma. Several dissertations were also reviewed that provided insight on the historical view of project success. Several peer-reviewed articles provided literature on the relationship between project success, Six Sigma, and mentors. Team productivity was examined using germinal books authored by Campanella (1999) and Montgomery (1999). Insight was gained on the historical aspect of project success with a review of several peer-reviewed articles, journals, and dissertations.

History of project success. Project success has a long evolutionary history, dating as far back as when the first human shelter was erected. Relevant history of project success for this literature review dated back to the start of scientific management, and Six Sigma evolved from that time. In the 1950s and 1960s, the topic of project success was not considered of primary importance in the United States, but starting in Japan in the early 1950s, many companies embraced the quality principles of Deming (1986) and Juran (1974). To make the quality movement toward process measures more attractive to companies in the United States, quality methodologies were repackaged and sold by consultants (Crosby, 1979). Gradually, the quality movement took hold in the business world, and organizational leaders began to “think and talk about organizational effectiveness” (Scott, 2003, p. 356). Six Sigma project management originated in the
quality movement. Gillard and Price (2005) remarked the following on management’s quest for improvement through the quality movement:

> Management lends itself well to prescriptions for improving organization function. Attempts to assist in the quest for effectiveness, such as Total Quality Management (TQM), Management by Objectives (MBO), Management-By-Walking-Around (MBWA), Management by Exception (MBE), ISO 9000, and Six Sigma, focus organization managers on techniques. (p. 48)

The modern view of project success is that organizations need to define the specific criteria necessary to enable growth, innovation, and reliability (Scott).

*Project success defined.* Defining project success includes more than establishing whether projects meet budgets and timelines (Revay, 2003). Critical success factors for project management include management support, project schedule plans, impacted parties, personnel, training, mentor relationship, technical tasks, monitoring and feedback, communication, team leader characteristics, organizational politics, environmental events, and urgency associated with the project (Coronado & Antony, 2002; Pinto & Slevin, 1989). Project success is defined through several performance measurements as determined by the organizational leaders hosting the projects (Breyfogle, 2003; Jones & Schilling, 2000; Pande et al., 2000).

Examples of project success factors are (a) 50% cost reduction, (b) elimination of material waste, (c) 95% reduction of customer complaints caused by product construction errors, and (d) 80% reduction in unscheduled production downtime. Project success is determined by the degree to which the project objectives are met and by the sustainability of project improvement. Organizational leaders and project participants determine project
completion (Coronado & Antony, 2002; Voelkel, 2005). In the context of this study, a
desk study was conducted of the defined goals and objectives of each project and
compared them to the attainment of the goals and objectives reported at the completion of
each project. Participants were also asked questions to rate the project success for
completion of the project goals and objectives, adherence to the project timeline, and
sustainability of the project after its completion.

described varying criteria for measuring success. The units of measure for each project
success are specific to the process involved. For example, a project to improve invoice
accuracy might measure the percentage of invoices returned due to errors (Juran &
Gryna). To determine project success, the goal might be to reduce the number of returned
invoices by 95% within the project timeline of three months. The project is considered
successful if the number of returned invoices is reduced by 95% within three months.
Varying degrees of success can apply, using project success metrics. For example, the
project can also be considered successful if the returned invoices are reduced by 80%
within the allotted timeframe.

Herman et al. (1997) argued that, historically, success had been the result of
metric modifications made to the goal model. Organizational leaders can measure project
success in terms of the business metrics that have the greatest impact on top management
issues, which are quality costs as they relate to sales, profits, shares of common stock,
cost of goods sold, total manufacturing costs, and the break-even point (Gupta, 2003;
Juran & Gryna, 1993). Organizational leaders who adopt the quality movement focus on
defining project success as it relates to the customers’ definition of quality, better known
as the customers’ definition of key critical-to-quality measures (Breyfogle, 2003; Pande et al., 2000; Scott, 2003). Organizational leaders seek to measure project success on efficiencies that show improvement, and they focus on the elements that match the organization’s stated goals (Thompson, 2003). All organizational leaders agree that the measurement of project success is necessary for understanding how the completed project meets the criteria that define success.

Project success to Six Sigma mentors. The relationship between Six Sigma mentoring to project success is understood as a cross-cultural approach to organizational change (Crom, 2000). Successful implementation of Six Sigma projects is dependent on an organizational infrastructure that includes training, tools, and mentor-type human relationships (Henderson & Evans, 2000; Laframboise, 2002). According to Hayes (2005), there is a greater degree of project success if both mentor and mentee “devote time, energy, and resources to the success of the relationship” (p. 444). Relevant literature that links the relationship of the project’s success to the mentoring aspect of Six Sigma is limited.

The desk study compared the defined goals and objectives of each project to the results reported at the completion of each project. Additionally, the participants were asked to rate the project success for completion of the project goals and objectives, adherence to the project timeline, and sustainability of the project after its completion. Based on the information provided by the literature review on project success, the effectiveness of mentoring on Six Sigma projects was examined by identifying the degree to which the projects met the following criteria:

1. Critical success factors for project management.
2. Management support.
3. Project schedule plans.
4. Impacted parties and personnel.
5. Project management training.
8. Monitoring, feedback, communication on the project.
9. Team leader characteristics.
10. Organizational politics
11. Environmental events.
12. Urgency associated with the project.
13. Defined through several performance measurements as determined by the organizational leaders hosting the projects.
14. Success measures are specific to the process involved.
15. Business metrics have the greatest impact on top management.
16. The customers’ definition of quality as defined by the key critical-to-quality measures.
17. Result of metric modifications made to the goal model.
18. Efficiencies that show improvement and focus on the elements that match the organization’s stated goals.
20. Organizational infrastructure including training, tools, and mentor-type human relationships.
21. Mentor and mentee devoted time, energy, and resources to the success of the relationship.

Relevant literature that links the relationship of the project’s success to the mentoring aspect of Six Sigma is limited. Project success needs to be identified and analyzed with historical data recorded in the project notebooks and with the questionnaire that explores degrees of variation of project success factors based on the literature.

*Study Context*

The literature relevant to this study includes the identification, application, and relationship of the contextual factors associated with the research problem. This section on the context of the research study includes a description of the host organization for the study, the organization’s relationship to the parent company, and the description of the sample. The employees targeted for the research study were screened for their status with the company and their Six Sigma experiences. The environmental factors were the local area where the individuals in the sample work and the organizational setting including the time when the study was conducted and the social atmosphere in which it was conducted. In this study context section, the research also includes a demographic analysis of Duncan, South Carolina, home to the supply chain and fulfillment business, and a review of the relevant literature and available scholarly research.

*Organization hosting the study.* The host organization is a daughter company to a privately held German company on five continents. The host business has over $3.7 billion in revenues and over 20,000 employees. The organization “supports more than 100 Fortune 1,000 clients in 23 countries, . . . in telecommunications, information technology, media, automotive, financial services, healthcare, travel and education
markets” (Arvato Services, n.d., p. 1). The parent company provides the host company with the freedom to manage the business with entrepreneurial finesse. This freedom is also extended from the global headquarters in Brussels, Belgium, to the North America headquarters in Valencia, California and the East Coast regional headquarters in Duncan, South Carolina.

For over 50 years, the supply chain and fulfillment business has supplied high quality logistics and order fulfillment solutions in customer care relations, fulfillment, offset printing, on-demand production, and supply chain management. The organization’s “global IT platforms and unique, linked data centers create networking capabilities for output and fulfillment operations anywhere in the world” (Arvato Services, n.d., p. 1). Their production capacities and technologies provide clients with competitive advantage through cost savings, efficiencies, and concept to market cycle times (Arvato Services, n.d.).

The organizational setting. As a response to changing environments, the leadership team at the North America headquarters of the host organization chose to force an organizational paradigm shift in one division of the corporation. The decision was made because of the changing business environment when the host organization contracted to service a customer who demanded Six Sigma processes. The host organization forced the change in its operational processes at the Duncan, South Carolina facility. The paradigm shift for the operational processes entailed incorporating a formal management system and the application of Six Sigma methodology to the current processes.
The host organization recently acquired a significant contract with a major software company for customer order fulfillment. Intuit is a practicing Six Sigma organization and requires suppliers to also use the Six Sigma methodologies. The host company engaged operations for the Intuit contract in November 2003 at the Duncan location. The process of order fulfillment includes receiving Internet and telephone orders from consumers as well as procuring the components to assemble software packages and to include software diskettes and instruction booklets as required by the customer product assembly instructions. The supply chain and fulfillment company packages the software in a custom shipper to display the unique consumer addresses and ships the order to the consumer using presorted shipping service levels. The production demand of the order fulfillment business is cyclic depending on the launch date and the peak season of product group sales and can vary dramatically throughout the year. The typical peak season starts in October and ends in April. Despite a stable and skilled staff employed all year, temporary unskilled laborers are brought in to add flexibility to the operating capacity in the peak season. The full-time employee headcount including direct and indirect labor employed throughout the year is 140. The temporary labor pool can reach 300 individuals from the local geographic area. With a high ratio of temporary to full-time workers in the order fulfillment area, the operational processes need to be well established to enable fast on-the-job training.

Leaders at the Duncan location possessed the expertise and capacity to set up operations for the increased volume in the fall of 2003. With an open system as an organizational model, the operational processes evolved so quickly in reaction to the increased business that efficiency was not as good as it could have been in the new
processes. The customer took exception to the operational inefficiencies and assigned resources in the form of several Six Sigma black belts to identify causes for the operational inefficiencies and to implement solutions. The imposition of the client’s Six Sigma black belts drove the host organization’s leadership team to restructure the division’s leadership at the Duncan location and initiate a culture change to improve organizational efficiencies by implementing its own Six Sigma program.

An employee of the German parent company with 19 years of distribution experience with the affiliate company was assigned to the position of Vice President of East Coast Distribution, at the Duncan, South Carolina location, in December 2003 (Arvato Services, n.d., p. 1). The VP of East Coast Distributions, understanding the challenge to optimize operational processes under the scrutiny of the new customer, assessed the leadership staff and found the need to improve the technical expertise. The VP realized the need to acquire Six Sigma expertise and demonstrate that the organization had operational control over process variation. A quality professional with a Six Sigma master black belt certification was hired to the position of North America Quality Director. This new leader was challenged with the responsibility to optimize processes and improve productivity at the order fulfillment operation in Duncan, South Carolina.

The employees targeted for the research study. The population at the host organization included five champions, five project leaders (one black belt and four green belts), and 25 team members (yellow belts). Figure 1 illustrates the hierarchical structure of the Six Sigma program participants at the host organization. The arrows in the figure symbolize the mentoring relationships studied in the research.
In preparation for the Six Sigma program, the company organized the infrastructure necessary to support the Six Sigma process improvement teams by training the VP East Coast Distributions, the four directors, and the five managers in the Six Sigma methodology to form a Steering Committee. The Six Sigma Steering Committee consisted of process owners of the supply chain and fulfillment operations, and five were champions to Six Sigma projects. The role of the Six Sigma Steering Committee was to select Six Sigma projects, assign project leaders and teams, align resources, and review Six Sigma projects at phase reviews. Those assigned as champions to a project were responsible to coach and mentor the project leader, remove barriers, and provide resources. The champions were the first subgroup examined in this research study.

The master black belt was also the North American quality director for the host organization who conducted the training of the champions and green belts and had the responsibility to develop the Six Sigma leadership infrastructure in the organization. The master black belt mentored the individuals in the organization engaged in Six Sigma. The efficacy of the master black belt’s role as mentor was a topic considered in the study.

The first wave of employees trained as Six Sigma project leaders consisted of one black belt and four green belts. The black belt was a full-time resource dedicated to the Six Sigma initiative, and the green belts were part-time resources, dedicating approximately 30% of their time toward Six Sigma initiatives. The green belts also integrated Six Sigma into their daily job duties. Their role in the Six Sigma program was to lead project improvement teams by using the Six Sigma tools learned in their training classes. The black belt attended a training program at an off-site location provided by an independent training program. The black belt’s training consisted of four 40-hour training
weeks totaling 160 hours. The master black belt provided the green belts training that included four 20-hour training weeks totaling 80 hours. The black belt also attended the green belts’ training and assisted the green belts with Minitab®, the statistical software used in the training. The project leaders, black belt and green belts, led the Six Sigma process improvement teams and delivered just-in-time training to the yellow belts on the Six Sigma tools during project team meetings. The black belt and green belts were the second subgroup examined in the study.

The Six Sigma yellow belts were the members of the process improvement teams led by the black belt and green belts. The yellow belts were manufacturing workers and subject matter experts for the processes considered for the improvement projects. The yellow belts’ participation was assigned by the Steering Committee at team formation for each selected project. The yellow belts were the third subgroup examined in the study.

*Demographic profile of Duncan, South Carolina.* Analysis of the Census 2000 Demographic Profile of Duncan, South Carolina, revealed that Duncan is an outlying suburban area with a population of 2,870 (U.S. Census Bureau, 2000) and approximately 862 families (Key to the City, n.d., p. 1). Duncan is 97 miles north of the South Carolina state capital of Colombia, 63 miles from the northeast corner of Georgia and 45 miles from the North Carolina state line. The neighboring cities, Greenville to the west, and Spartanburg to the east, are within 10 miles of Duncan. The profile of the dominant lifestyle in the Duncan, South Carolina, area revealed that the residents have a median age of 27.9 years (U.S. Census Bureau). The average person born and raised in South Carolina has no intention of moving to a different county (Re/Max, 2004). The majority of the households are families with children living at home and have less than $25,000
annual household income with 3.1 persons per family (Re/Max). The majority of adults, 68.9%, have completed high school, and the people in the Duncan area are dependent upon manufacturing and farming for work (U.S. Census Bureau). Most homes in Duncan were built after 1970 and are valued at less than half the national average, with 70% single-family houses, 23% mobile homes, and 80% of the homes owner-occupied. The 5.2% unemployment rate is lower than the national average, and 20% of the households rely on retirement income (Re/Max).

**Literature review for the study context.** This section of the review includes relevant available scholarly literature regarding the setting of the research study. The scope of the literature addressing the context included three categories: (a) Six Sigma implementation in small to mid-size companies, (b) implementation of Six Sigma, and (c) a small southern country town.

The study setting provided by the host organization is a small to mid-size company with 140 full-time employees and up to 300 temporary laborers from the local geographic area during peak seasons. Recent surveys showed that 99% of all businesses in the United States employ fewer than 500 employees and are generally small make-to-order operations (Conner, 2001). Gupta (2003) defined a small company as having approximately 100 employees. The specific focus of a quality program is based on the size of a company. Small to medium-sized companies focus on motivational aspects and implementation procedures whereas large companies focus on statistical results in addition to employee involvement, motivational techniques, and procedural improvements (Arauz & Suzuki, 2004). Small and medium-size companies are reported
to save approximately $150,000 per black belt project, with each black belt completing multiple projects per year (Klefsjo, Wiklund, & Edgeman, 2001).

Implementation of Six Sigma involves the leveraging of a few high impact variables: (a) senior leadership support, (b) close communication with customers, (c) employees and suppliers, (d) rigorous training, (e) a continuous improvement framework, (f) a process mindset, and (g) project teams led by black belt and green belt (Pyzdek, 2003). According to Kotter (1996), the successful implementation of change management includes the following linked steps that management must take: (a) creating a sense of urgency, (b) creating and communicating a vision, (c) empowering employees, (d) planning short-term wins, (e) replicating improvements, and (f) institutionalizing new behaviors. The critical elements needed to execute Six Sigma project management include time, resources, and project objectives (Breyfogle, 2003).

According to Piorier (2002), the charm and authenticity of a small town contribute to making it a desirable place to live and work within a rural community and a green environment. Small towns are regarded as having populations of fewer than 10,000. Organizations in small towns can benefit by investing in job-training programs and contributing to voluntary activities and the development of the economic community (Atkinson, 2001; Moore, 1999).

Summary

In the context of this research study, Six Sigma was examined as a mentor program that influenced project success in a supply chain and fulfillment company in a southeastern region of the United States. The impact of mentoring on the collective success of individuals in three subgroups was the focus of the data collection using a
design with embedded multiple units of analysis. As a mentor program, Six Sigma offered different levels of expertise, master black belt, champions, black belts, green belts, and yellow belts (Breyfogle, 2003). Three subgroups, champions, project leaders, and yellow belts, were studied to understand the unique mentoring experience of the subgroups and to discover their perspective on the contribution mentoring had to project success.

As a mentor program, Six Sigma was discussed in the literature, but the Six Sigma mentor relationship was not directly researched. The different roles in a Six Sigma organization were defined as responsibilities. Mentors were tentatively defined as experts who offered assistance on projects, removed barriers, and critically reviewed projects (Breyfogle, 2003; George, 2003; Gupta, 2003). The literature addressed project success in organizations, but it was limited in the area of linking project success with mentoring relationships. The term guru was used to define the “quality expert who is looked up to for their vast knowledge and leadership on the subject” (Phillips-Donaldson, 2004, p. 6). Six Sigma leaders were also mentioned as role models while the mentor relationships in the literature were used to describe transformational leaders, cross-functional teams, and self-managed teams (Hamamoto, 2002).

The scope of the literature review included the history of Six Sigma and mentors from their origin to modern day. The organizational leadership in a Six Sigma organization was well documented in several sources (Breyfogle, 2003; Pyzdek, 2003). Transformational leaders, gurus, role models, coaches, and champions are terms used to describe this leadership from the Six Sigma leaders’ perspective. The literature did not examine the relationship between the Six Sigma leaders and their peers or subordinates.
The literature review indicated that Six Sigma is universally accepted as a culturally changing program led by transformational leaders and experts. The literature that examined the relationship that the Six Sigma experts have with the people in the organization was minimal. One of the goals of this study was to add to the existing literature about the relationship between Six Sigma mentoring and project success in the workplace. This research study might add to the leadership and Six Sigma body of knowledge for those planning to employ Six Sigma and for those who are looking to refine their current programs for increased opportunities using continuous process improvement.

The literature reviewed was limited in addressing the relationship of the independent variable, Six Sigma mentoring, to the dependent variable, project success. Although this preliminary literature review suggested that project success is a relatively old focus for the human race, the definition of project success as affected by mentoring in organizations is relatively new. Many organizational leaders defined their key measures regarding project success, and they monitor these measures closely. The business factors monitored for projects are sometimes selected because they are convenient and focus on positive business variables (Thompson, 2003). Organizations that employ Six Sigma link their improvement efforts to their business metrics. As a mentor program, Six Sigma offered techniques to nurture employees and promote individual success thus promoting collective success of individuals who could improve project success.

The study was conducted in a small to mid-size company (Gupta, 2003) with 140 to 440 employees at peak season. The company is located in a small rural town located in Duncan, South Carolina, and it implemented Six Sigma methodologies for continuous
improvement. The review of this setting helped develop the demographic profile of the research study participants as being part of a small population living in an area with economic challenges. Some limitations in the literature were identified where there appeared to be a void about the implementation of Six Sigma in small to medium size companies located in small rural towns. The literature reviewed did not include studies of the relationship between the Six Sigma leaders and their peers or subordinates. Studies were also lacking on the relationship between Six Sigma as a mentor program and project success.

Conclusion

Chapter 2 provided a review of the existing literature and identified areas where additional research could be conducted. The purpose of this literature review was to delineate the independent variable, Six Sigma mentoring, and the dependent variable, project success, in relation to the research study. The breadth of literature regarding the dependent and independent variables was described. The literary sources researched included peer-reviewed journals, dissertations, resource books, and periodicals available on the Internet and at various university libraries. The study context included a review of the small to mid-size company located in Duncan, South Carolina, the setting in which the study took place. The evidence in the literature suggested a gap in the research regarding the study of Six Sigma as a mentor program and the relationship to the dependent variable, project success, and small to mid-size companies practicing Six Sigma located in a small southeastern town.

Chapter 3 presents a detailed review of the research methodology and the instruments used to conduct the survey. The intention of this embedded single-case study
was to either support or refute the hypothesis that Six Sigma mentoring can increase project success (Yin, 2003). In chapter 3, the study participants are defined as the three hierarchical groups of Six Sigma, and the methods used to survey and interview them are explained. The instruments used to conduct a self-evaluative examination of how mentoring influenced project success and the methods of analysis for the data collected are also explained.
CHAPTER 3: METHOD

The previous two chapters described the fundamental nature of the research study, the relevance of the study to the field of leadership, and a review of the related literature. Chapter 1 introduced the research, defined Six Sigma as a modern formal organizational mentor program, and identified why this knowledge is important to understand how project success is affected by Six Sigma mentoring. Chapter 2 presented the literature review for the dependent variable, project success, and the independent variable, Six Sigma mentoring. In chapter 2, the context of the study is also described as a supply chain and order fulfillment company in South Carolina. Included in chapter 3 is a detailed description of the research design methodology and the instruments that were used to conduct the study. This chapter also presents a discussion on the appropriateness of this research to the field of leadership and addresses the validity of the research.

Research Design

This chapter elaborates on the nature of the study presented in chapter 1. The investigation is defined as an embedded single-case study using a mixed methods design that explored how mentoring affects project success as studied at the host organization located in Duncan, South Carolina (Yin, 2003). The embedded single-case study design was used at a single organization and included more than one unit of analysis (Yin). The embedded units were the subgroups associated with the three levels of Six Sigma expertise, champions, project leaders, and yellow belts. Figure 2 is a graphical representation of the research process, identifying the process steps with relevant inputs and their respective outputs.
Figure 2. Graphical representation of the research process.

Note: Figure 2 was created for the purpose of this research study to display relationships between the inputs and outputs of the research process.

The research instruments that were developed included a quantitative questionnaire and a qualitative interview instrument with open-ended questions. The results from the questionnaires were analyzed for each response and comparisons were made between the responses from each participating subgroup. This design application was appropriate because the goal of the study was to examine the effects of mentoring from the perspectives of the project champions, the team leaders, and the team members. The questionnaire was constructed with a Likert-type scale and the data were triangulated...
with qualitative data obtained from interviews in order to validate the study results. This method was selected over other design methodologies because it best met the goals of the research. The embedded single-case study design allowed the researcher to compare, delineate, and validate the three perspectives of Six Sigma program participants in the subgroups.

The study design incorporated an embedded single-case study using a mixed methods design to conduct research with overlapping triangulation of quantitative and qualitative data collection methods (Yin, 2003). In the embedded single-case study, three unique groups were studied to understand the varying perspectives each group had on the mentor relationship (Yin). Triangulation was used to enhance, validate, corroborate, or refute the emerging findings from three different groups of Six Sigma program participants, each assigned a different role (Delich, 2004; Welch, 2004). The data were triangulated by collecting quantitative and qualitative information and merging the results to better understand the research problem (Denzin, 1970; Foreman, 1948; Mathison, 1988; Merriam, 1998). Overlapping triangulation consisted of cross-referencing research questions using both quantitative and qualitative inquiry methods. It was used to enhance confidence in the validity of the results by (Denzin, Foreman).

Figure 3 depicts the multiple triangulations used to organize the data. Each subgroup was given a questionnaire with a Likert-type scale that generated quantitative data and was also interviewed. The open-ended questions in the interviews generated qualitative data. The quantitative and qualitative data collection methods triangulated the data from the three subgroups, and the two methods were used to strengthen the validity of the findings. The survey and the interview questions addressed the same ideas. The
Likert-type scale was a 5-point scale. The interview questions were open-ended to allow the participants to elaborate on their experiences. Two forms of triangulation, data and methodological, were used to collect and analyze the research results. By using multiple forms of triangulation, the truest possible portrayal of the effectiveness of mentoring on project success for each subgroup was obtained.

![Diagram of multiple triangulations used for embedded design.](image)

**Figure 3.** Diagram of multiple triangulations used for embedded design.

**Note:** Figure 3 was created for the purpose of this research study to display the study methodology between subgroups.

The first form of data triangulation was the gathering of data from several sources so that the various participants in the research study could give different perspectives (Denzin, 1970; Maggs-Rapport, 2000). The use of data triangulation included the collection of data from three different participating subgroups, steering committee (champions), project leaders (black belt and green belts), and team members (yellow...
Each subgroup provided a different perspective of the mentor relationship (Figure 1). The master black belts and champions mentor the project leaders. The project leaders mentor the team members. Project leaders and team members receive the mentoring relationship. The champions also receive some mentoring from the master black belts, but this relationship is limited and was not measured in the study. The three subgroups of participants were used to validate, corroborate, or refute the emerging findings thereby addressing the research questions from different viewpoints.

The second form of triangulation was methodological. It used a combination of quantitative and qualitative data collection methods (Denzin, 1970; Maggs-Rapport, 2000). The methodological triangulation data collection was conducted by means of a written questionnaire of all research participants combined with qualitative interviews with all the survey participants. Equal weight was placed on both data sources (Denzin, 1970; Foreman, 1948).

The quantitative portion of this study was carried out with a 5-point Likert-type written survey instrument and was piloted to collect data from the Six Sigma participants on their view of project success as a result of their mentor relationship. All participants answered the same set of written quantitative questions. The qualitative portion consisted of interviews with the same participants on the same topics as the written questionnaire regarding their view of project success as a result of Six Sigma mentoring. The qualitative questions were open-ended and supported the questions in the written questionnaire.

The quantitative and qualitative methods overlapped in design to validate the results through triangulation. The survey results were validated by merging them with the
qualitative data during analysis (Denzin, 1970; Foreman, 1948). The triangulation technique was used to enhance the validity of the research results by converging and comparing the themes emerging from the quantitative data with the qualitative data. Statistical data analysis techniques were used to discover how the results support or refute the research hypotheses (Denzin; Foreman).

Appropriateness of Design

The quantitative and qualitative techniques provided different methodologies for data collection and analysis as a methodological triangulation design. The three subgroups were categorized by role in the Six Sigma program. The subgroups provided different mentoring perspectives, and the two study methods combined formulated a multiple triangulation with multiple units of analysis design (Denzin, 1970; Foreman, 1948; Mathison, 1988; Merriam, 1998). This data triangulation design for multiple subgroups was appropriate for the study because it used the hierarchal levels of the Six Sigma culture in the study design for data triangulation. The design delineated the natural separation of skills based on Six Sigma training and expertise regarding program management, project leadership, and statistical application of the Six Sigma methodologies (Breyfogle, 2003; Pyzdek, 2003).

This design was appropriate to the field of leadership because it allowed observation of the leaders’ ability to transfer knowledge and tasks to subordinates. Bass (1990) suggested that “the emergence of leadership is correlated with how much the emergent leader’s abilities are relevant to the tasks that the group faces” (p. 614). Bass further discussed the subordinates’ ability to take on tasks as instructed by leaders when
leaders express confidence in their subordinates. In this study, the relationships from leaders to subordinates and the relationship from subordinates to leaders were observed.

The champions assign project leaders with a task to accomplish and project leaders work through team members. Project leaders accept tasks from the champions as do team members, the subordinates of project leaders (Breyfogle, 2003; Pyzdek, 2003). The results of the task transfer within the relationships, leader to subordinate and subordinate to leader, were the prime focus of this study (Bass). How leaders, as mentors, affected the participants’ ability to contribute to project success was examined.

The chosen design accomplished the goals of comparing one group to the other because it divided the participants into the natural subgroups based on their level of Six Sigma expertise (Denzin, 1970; Foreman, 1948). The data collected were categorized based on the identity of the three subgroups, but individual identities were not revealed. This allowed for an unbiased comparison of one group to the other and vice versa. If the data had been collected from a single group, the discrimination of the multiple levels of leadership would not have been be visible, making the research less significant to the study of leadership.

The methodological triangulation helped validate or refute the data collected from the three subgroups. If the data had been collected with only a quantitative methodology, the small sample size would have rendered the validity of the data questionable. If the data had been collected using only qualitative methods, the validity of the results also would have been questionable. The multiple triangulations mixed methods approach offered balance to the design by giving equal weight to each of the three subgroups studied and to each of the data collection techniques (Denzin, 1970; Foreman, 1948;
The embedded research design elicited the Six Sigma mentoring experiences for each subgroup studied. The research design suited the theoretical framework of the study and fulfilled the purpose of the research. The design was expected to show sufficient detail to suggest answers to the research questions and was justified and appropriate for the desired outcomes of the embedded single-case study (Yin, 2003). The mixed methods research design led to recommendations for further research exploration.

There has been little previous research on the effects of Six Sigma mentoring. No current theory was found about the effects of Six Sigma mentoring on project success. This study was exploratory and investigated the effects of Six Sigma mentoring on project success through the study of the effects that mentoring has on project success for three subgroups.

Feasibility of Design

Yin (2003) described the rationale for designing research studies with single rather than multiple case studies and described the basic types of case study designs. A single-case design study is conducted with a single organization at one location. A multiple-case design applies to a research study where more than a single case is studied, including one organization with multiple locations or multiple organizations. The scope of this research study was limited to one organization located in Duncan, South Carolina.

Using a single case design was appropriate for this study for two reasons. First, the specific Six Sigma program at this organization was representative of other organizations with Six Sigma programs. The Six Sigma program was used for its operational excellence and continual improvement initiatives as well as to reduce
operating costs in the operational and transactional processes of the organization. The mentoring aspect of Six Sigma used at this organization was typical of Six Sigma programs. The organizational structure of the program was hierarchical with the various levels of expertise, master black belt, champions, black belts, green belts, and yellow belts (Breyfogle, 2003; Harry & Schroeder, 2000; Pande et al., 2000; Thomerson, 2002; Value Based Management, 2004).

The single case design was also appropriate because it enabled a theory building type of research considering the limited knowledge on the effectiveness of Six Sigma mentoring on project success. The embedded single-case study design was also best suited for this research study because, as a theory building type of research, it had a limited scope for practical reasons (Yin, 2003). This type of study required in-depth interviewing and qualitative analysis within a manageable scope. After considering the several types of case study research designs, the embedded single-case study using a mixed methods design was determined to be best suited and most appropriate for this research study. The embedded single-case study design was feasible for this research study because this specific Six Sigma program in the host organization in Duncan, North Carolina was representative of other organizations with Six Sigma programs.

Research Questions

As stated in chapter 1, in order to study the effects of mentoring on project success, this single-case study sought to contribute to current theories by answering the following two research questions about the overall effectiveness of Six Sigma mentoring and the differences in the effects of mentoring on the participating subgroups:
R1. How does Six Sigma mentoring affect project success in a Six Sigma organization?

R2. How does the effectiveness of mentoring on project success differ for champions, project leaders, and team members?

Population

The population selected for this research study consisted of all the Six Sigma project participants at the host organization, specifically five champions, five project leaders (one black belt and four green belts), and 25 team members (yellow belts). The actual population used in the study differed slightly from the proposed population because some people had left the organization and were no longer available after the Six Sigma projects were completed. The host organization, a division of a global German company, is a full supply chain and order fulfillment operation for electronic multimedia. The host organization is located in Duncan, South Carolina, a small town community located in the northwestern region of South Carolina. The researcher who conducted this study is a master black belt as well as the North America Quality Director at the host organization. Because of her executive position in the organization, she received access and the authority to conduct the research study.

The participating population at the host organization targeted for the research study included all the available Six Sigma project participants, five champions, five project leaders (one black belt and four green belts), and 25 team members (yellow belts). Figure 1 illustrates the hierarchical structure of the Six Sigma program participants at the organization. General rules for determining sample size for small populations (N < 100) are suggested by Gay (1996). He suggested that the questionnaire should be administered
to the entire population as opposed to sampling a portion of the population. Due to the relatively smaller number of participants in this research study, \((N = 40)\), all available participants were included in the study.

The individuals expected to participate were identified in the Six Sigma project notebooks prepared by the project leaders. They were identified as champion, project leader, and team members associated with each project. The participants’ names were accessed using this documentation although their identities remained confidential. Program participants who had remained at the Duncan location were asked to participate in the research study.

Critical success factors for project management included (a) management support, (b) project schedule plans, (c) impacted parties, (d) personnel, (e) training, (f) mentor relationship, (g) technical tasks, (h) monitoring and feedback, (i) communication, (j) team leader characteristics, (k) organizational politics, (l) environmental events, and (m) urgency associated with the project (Coronado & Antony, 2002; Pinto & Slevin, 1989).

These factors were kept constant by only including the teams of one wave of Six Sigma projects. All participants in each subgroup were subjected to the same management team, they all had the same project timeline, the impacted parties were of the same organization, and the personnel were assigned to specific teams based on their close association with the process involved in the project.

All subgroups were trained on the same technical project tools, all projects were reviewed at the same time and subjected to the same level of feedback, internal and external communication were similar for each team, and the organizational politics, environmental events, and project urgency were also the same for all groups. Differences
between participants were individual personality traits and individual mentor relationships. Only the relationship of the Six Sigma mentors to the participants’ experience in the program was examined because this relationship would reveal the kind of impact, if any, that mentoring had on project success.

The study participants had not been involved in Six Sigma projects within the past six months due to business demands requiring alternative assignments. This factor might have adversely influenced the research results or might have affected some employees’ willingness to participate in the research study. Though refusal to participate was not anticipated, continuing the study with fewer data points was considered. If individuals had communicated that they did not want to participate in the study, interviews would have been conducted to discover their reasons, and the low risk and short time commitment involved in their participation would have been explained to them. If individuals still had refused to participate, a note of their reasons for non-participation would have been recorded in the research notebook next to those participants’ unique code. These participants’ data would have been omitted from the research study, and the research study would have continued. No one declined participation, though three team members were not included in the study because they were removed as team members on the project team before the project was started. The reason for non-participation was recorded in the research notebook next to those participants’ unique code.

Informed Consent

Permission to use the premises was granted by the Vice President of East Coast Operations on the Permission to Use Premises form (Appendix C). Participants in this
research study were asked to participate on a voluntary basis and were given an Informed Consent Form (Appendix D) that clarified the research study information.

Confidentiality

The identity of the participants and their association with the data sets remained confidential. The written survey was conducted anonymously. All respondents completed demographic questions that categorized them into respective data sets, but neither the participants’ identity nor their association with the data set was used in the study. The final survey was distributed by email, and respondents responded by email or in hardcopy. Regardless of the method of response, confidentiality for all participants was maintained.

Geographic Location

The host organization is a division of a German privately held global company. The global headquarters is in Brussels, Belgium, with the North America Headquarters in Valencia, California, extending to the East Coast regional headquarters in Duncan, South Carolina. The research study was conducted in Duncan, South Carolina, at the East Coast regional headquarters location. All participants in this research study were accessible at the Duncan site.

Instrumentation

The data collection instruments were developed by creating a quantitative questionnaire and preparing a list of interview questions based on the results of the literature review. The literature review was used to formulate statements for the quantitative survey so that the participants could rate each statement using a 5-point Likert-type rating method for how strongly the statement reflected their experience with
Six Sigma mentoring and project success. The quantitative survey (Appendix A) was developed using the results of the literature review of Six Sigma mentoring on project success. The survey was designed with Part A to develop a participant description, Part B for project success, and Part C for mentoring effectiveness. The written survey included 64 questions.

Part A included profile type questions including age, gender, job function, education, project experience, the project team of which the participants were members, and the participants’ role on the team. A question was asked to place them into a subgroup of Six Sigma participation, champion, project leader, or team member and to place them on a specific team in order to establish the participants’ codes. The subgroup was used in the data analysis as a basis for comparison of each subgroup’s experience with Six Sigma mentoring.

Part B included questions about the participants’ experiences with project success. The first four questions inquired about the success of the specific project objectives, namely meeting the project plan timeline, long-term sustainability of the project accomplishments, and the overall success of the project. Twenty statements followed these questions and addressed project success based on the literature review of the dependent variable. The statements were rated using a 5-point Likert-type rating scale. The results were used to determine the level of project success for each project and to determine the participants’ experience with the project success.

Part C included questions that inquired about the participants’ experiences with Six Sigma mentoring. Three questions asked about the participants’ experience as mentors or mentees. These questions were followed by 27 statements regarding
effectiveness of mentoring based on the literature review of the independent variable. The
dependent variables were rated using a 5-point Likert-type rating scale. The results were used to
determine the effectiveness of Six Sigma mentoring for each participant and to determine
the participants’ experience with the mentoring.

Using the literature review on the dependent and independent variables, open-ended questions were developed for the qualitative portion of the study that corresponded
to the survey questions. The qualitative survey is referenced in Appendix B. The
interview questions were divided in Part A to categorize the participants into subgroups and project teams, Part B for inquiring about project success, and Part C for inquiring about mentoring effectiveness. One question for each main topic was developed for the
effects of Six Sigma mentoring on project success as examined in this study, totaling 13 questions for each interview. As in the quantitative survey, the participants in the qualitative interviews were also categorized into subgroups by Six Sigma participation as champions, project leaders, or team members. The subgroups were used in the data analysis as a basis to compare each subgroup’s experience with Six Sigma mentoring. Each participant was interviewed using the interview questions in Appendix B. Responses were recorded in a field notebook. Confidentiality of the recorded responses was maintained.

The survey was tested for validity by administering it to a pilot group in order to ensure that the questions were clear and precise. The pilot survey was conducted following research approval from the Institution Review Board. One project team identified in one of the project notebooks was selected to be the pilot test group and was given the survey. The project team represented 20% of the population. In addition to the
survey, the respondents were asked questions regarding the survey itself and the administration techniques. The feedback from the respondents was used to validate the survey and modify some questions to improve the overall instrument. The interview questions were also piloted with the same project team.

Data Collection

Multiple methods to collect data were used for this embedded single-case study (Yin, 2003). Artifact analysis included a review of the project leaders’ notebooks and project files to identify the participants for the research study and to develop the coding system to maintain participant confidentiality. A written survey was administered to the participants using a Likert-type rating system. Interviews were conducted with all participants. All Six Sigma project leaders constructed a project notebook to record the progress and results of their project. They also maintained an electronic project file on the organization’s shared server to use for knowledge sharing. The artifact analysis consisted of a review of the project notebooks and electronic files for each project. The artifact analysis enabled all Six Sigma program participants to be identified and to assign codes to each participant in order to assign the participants to subgroups.

The coding of the study participants is illustrated in Figure 4. Each project subgroup was identified using a letter code designation. The project sponsors were identified with a C for champions. The black belts and green belts were identified with a PL for project leader.
Figure 4. Coding of participants to delineate Six Sigma expertise and project team.

Note: Figure 4 was created for the purpose of this research study to display the coding of data used in the data analysis.

The black belts and green belts were not identified separately in order to maintain confidentiality for the single black belt at the host organization. This could be considered an opportunity for further research to understand the differences of the effects of mentoring between the two project leaders’ belt levels. The team members were identified with YB for yellow belts. These subgroup designations allowed the research to distinguish between levels of Six Sigma expertise and to examine the effectiveness of Six Sigma mentoring on project success for each subgroup in relation to the research question R2 and to understand how the effectiveness of mentoring on project success differed for the three subgroups.

Each project group was also identified by a sequential number designation. All participants for Project 1 had a 1 designation, participants for Project 2 had a 2 designation, and so on for participants for Projects 3, 4, and 5 respectively. This allowed trends to be identified within project groups. Yellow belts were also given a number
assigned to uniquely identify the participants at this level. With this coding system, each study participant was uniquely identified for the purpose of the study. The unique identification was used to maintain confidentiality of the study participants and was also used to link the quantitative survey to the participants’ qualitative interview. This link was used to validate the responses of individual participants. The collective answers from all participants were used to answer the research question R1 in order to understand how Six Sigma mentoring affected project success in a Six Sigma organization.

Qualitative data were obtained in face-to-face interviews using 13 interview questions (Appendix B). All participants were interviewed to ensure accuracy of the responses for each subgroup. The subgroups champions and project leaders included only five participants. With the small population of five, the sampling logic required the entire subgroup population to be considered (Yin, 2003). Although the subgroup yellow belts had a sample of 25, each project group had only five yellow belts. The sampling logic for small populations also applied to this subgroup (Yin). The questions used in the qualitative interviews were open-ended in order to allow the respondents to freely share their experiences. The responses to the interview questions were used to validate the corresponding answers to the quantitative questionnaire questions.

Data Analysis

The data were analyzed to answer the research questions. There was one quantitative survey and one individual interview for each participant. The data collected from the questionnaire were recorded on a spreadsheet to enable descriptive and inferential statistical analysis. Each participant was identified with a unique code. The quantitative questionnaire was administered before the individual interviews. The data
were analyzed from the quantitative survey following the administration of the survey and prior to conducting the individual interviews. Values were assigned for the answers to each question and ranged from 1 (disagree) to 5 (agree).

Data Analysis to Answer Research Question R1

Research question R1 inquired about the overall effectiveness of Six Sigma mentoring by asking: How does Six Sigma mentoring affect project success in a Six Sigma organization? The independent variable was Six Sigma mentoring and the dependent variable was project success. The relationship between the variables was analyzed by comparing the results of Part B and Part C of the surveys. Part B of the surveys measured project success, and Part C measured Six Sigma mentoring. This research question was answered using descriptive and inferential statistics, including correlation analysis and Homogeneity of Variance (HOV) analysis for each response. Using the assigned values for the survey answers, each survey question was analyzed to understand the response for the entire population and for each project team.

Project success and mentoring effectiveness were analyzed by comparing the descriptive statistics for the entire sample and also by project team. Descriptive statistics for each survey question included mean, median, standard deviation, variance, and range. Correlation analyses were conducted to understand the relationship between Six Sigma mentoring and project success. ANOVA was used to determine whether the Six Sigma mentoring and project success differed from project team to project team. Two ANOVA analyses were completed. The first was used to test for a variance between project teams for project success; the second was used to test for a variance between project teams for mentoring effectiveness. Descriptive statistics were completed for the entire participant
population in Part B and C related to the project success and individual mentoring effectiveness. Descriptive statistics included mean, median, standard deviation, variance, and range for each survey question. Descriptive statistics were also completed for each project team to understand if there was a difference between team project success, and mentoring effectiveness.

The effects of Six Sigma mentoring for the entire participant population and the success of individual projects were understood by testing for a correlation between project success and Six Sigma mentoring. To test for correlation between the two variables, project success was graphed on the y-axis, and Six Sigma mentoring was graphed on the x-axis. If a correlation existed, a test for probability was conducted. Probability analysis helped explain the relationship between the variables and see whether more effective mentoring was associated with a higher chance of a successful project.

Homogeneity of Variance (HOV) was used to test the variation in project success for the five project teams. The extent of project success for the accumulated Six Sigma projects and the success of individual projects was understood. The HOV test used was a one-way analysis of variance (ANOVA). ANOVA was used to test whether the project success means of the five teams were equal or not equal. If the ANOVA results determined that the means were equal, there was no difference between the five teams. If the ANOVA results determined that the means were not equal, there was a difference between the five teams. Further analysis of the data was conducted to determine the difference between teams.
Six Sigma mentoring was analyzed by comparing the descriptive statistics for the entire sample and also by project team. HOV was used to test the variation in Six Sigma mentoring for the five project teams. ANOVA was used to tests if the mentoring effectiveness means of the five teams were equal or not equal. If the ANOVA results determined that the means were equal, then there was no difference in mentoring effectiveness for the five teams. If the ANOVA results determined that the means were not equal, then there was a difference in mentoring effectiveness for the five teams. Further analysis of the data was conducted to determine the difference between teams.

ANOVA was used to compare multiple sample means to see if they differed significantly from each other beyond what would be expected by chance. The $p$-value was used to determine the probability of making a Type I (alpha) error, which defined the potential for drawing the wrong conclusions during testing from the statistical analysis. The $p$-value used in this study was 0.05, representing a 95% confidence level in drawing the correct conclusion from the data analysis. This potential was called the risk of making an error. The data were interpreted using the $p$-value where a value of less than 0.05 means that the sample is not part of the compared population and is different from the compared population (Breyfogle, 2003). A $p$-value of less than 0.05 means that there is a difference between the samples (Breyfogle) or subgroups in the case of this study. A $p$-value of greater than 0.05 means that there is no difference between the populations tested (Breyfogle). The five teams were the populations tested for variance using the one-way ANOVA analysis.
Data Analysis to Answer Research Question R2

Research question R2 inquired into the differences between how mentoring effects project team subgroup, champions, team leaders, and team members. Research question R2 asked: How does the effectiveness of mentoring on project success differ for the three subgroups? The data were grouped into three data sets, champions, project leaders, and team members. Project success and mentoring were analyzed by comparing the descriptive statistics for each subgroup. This research question R2 was answered using ANOVA to examine the relationship between the multiple sample variations and compare the subgroups to each other for the individual responses to the survey questions. The results identified what aspects of mentoring most affected the project success for each subgroup.

ANOVA was used to test whether the means of the three subgroups were equal or not equal. Two ANOVA analyses were completed. The first was to test for a variance between subgroups for project success; the second tested for a variance between subgroups for mentoring effectiveness. If the ANOVA results determined that the means were equal, mentoring had no effect or the same effect on all three subgroups. If the ANOVA results determined that the means were not equal, mentoring had a different effect on the three subgroups. If the three subgroups were not equal, further analysis was conducted to identify what mentoring factors were the most different for the three subgroups.

The data analysis plan is identified in Table 3. The table provides an explanation of the analysis of the research questions using the data collected in the quantitative
survey. The table identifies how the variables were studied, how the variables were measured, and how the relationship of the variables was analyzed.

Table 3

*Data Analysis Plan*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Variables</th>
<th>Population studied</th>
<th>How the variables were measured</th>
<th>How the relationship was analyze</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Project success</td>
<td>Total participants, and five teams</td>
<td>Quantitative survey</td>
<td>Descriptive statistics, correlation, ANOVA</td>
</tr>
<tr>
<td>R1</td>
<td>Mentoring</td>
<td>Total participants, and five teams</td>
<td>Quantitative survey</td>
<td>Descriptive statistics, correlation, ANOVA</td>
</tr>
<tr>
<td>R2</td>
<td>Project success</td>
<td>Three subgroups</td>
<td>Quantitative survey</td>
<td>Descriptive statistics, ANOVA</td>
</tr>
<tr>
<td>R2</td>
<td>Mentoring</td>
<td>Three subgroups</td>
<td>Quantitative survey</td>
<td>Descriptive statistics, ANOVA</td>
</tr>
</tbody>
</table>
Quantitative Data Analysis

The quantitative portion of the survey instrument was divided into three sections. Part A that included nine questions was to develop the participants’ descriptions and to assign them a unique code. Part B included two sections. In the first section, four questions inquired about the participants’ previous project team experience. The second section included 20 questions and was used to inquire about the participants’ project success experience on the Six Sigma project team. Part C included two sections. In the first section, three questions inquired about the participants’ previous mentoring experience, and in the second section, 27 questions inquired about the participants’ mentoring effectiveness experience on the Six Sigma project team.

Analysis of participants’ description. Histograms were used to graphically represent the population. Part A responses to Questions 1 to 5 were used to profile the participants by age, gender, job function, education, and project experience. The responses were used to control the variables of age, gender, job function, or education that could have interfered with question responses. Responses to Questions 5 to 7 were used to understand the participants’ role in previous project teams and to determine whether previous project experience was a confounding variable. Responses to questions 8 and 9 allowed a confidential unique code to be assigned to the participants and to assign the participants to a subgroup. Responses to the participants’ description questions were used to place them into groups and test for correlations between different age groups, gender, job function, or education. If any these factors were a high contributor in the test results, it was considered in the data analysis for research questions 1 and 2.
Analysis of project success. Part B of the survey instrument included questions about the participants’ experience with project success. Responses to Questions 10 to 13 were used to inquire about the success of the specific project objectives (i.e., meeting the project plan timeline, long-term sustainability of the project accomplishments, and the overall success of the project as experienced by each participant). Responses to the subsequent 20 statements identified as Questions 14 to 33 were analyzed using descriptive statistics and the data were displayed in histograms by project team. These data provided an understanding of the varying degrees of project success experienced collectively for each project team and helped identify which aspects of the Six Sigma projects were the most and least successful. Responses to Questions 14 to 33 were also analyzed using Homogeneity of Variance (HOV) to test for differences in the project success experienced by the subgroups of champions, project leaders, and team members. If a difference between the three subgroups existed, further analysis was done to compare the three subgroups and understand the degree of difference in project success using box charts and interval plots of the average subgroup results for that series of questions.

Analysis of mentoring effectiveness. Part C of the survey instrument included questions about the participants’ experience with mentoring and Six Sigma mentoring effectiveness. Responses to Questions 34 to 37 were used to understand the participants’ previous experience as mentors or mentees. Responses to the subsequent 27 statements identified as Questions 38 to 64 were analyzed using descriptive statistics, and the results were displayed in histograms by project team to understand the varying degrees of mentoring effectiveness experienced collectively for each project team and to identify which aspects of mentoring were the most and least effective. Responses to Questions 38
to 64 were also analyzed using HOV to test for differences in the mentoring effectiveness experienced by the subgroups of champions, project leaders, and team members. If a difference between the three subgroups existed, further analysis was done to compare the three subgroups and understand the degree of difference in mentoring effectiveness using box charts and interval plots of the average subgroup results for that series of questions. The results from the subgroups were compared for both project success and mentoring effectiveness.

**Qualitative Data Analysis**

The qualitative portion of the survey instrument was divided into three sections that corresponded to the sections of the quantitative survey. Part A included two questions and was used to identify the participants by the assigned unique code. Part B included five open-ended questions and was used to inquire about the participants’ previous project team experience and their project success experience on the Six Sigma project team. Part C included six open-ended questions and was used to inquire about the participants’ previous mentoring experience and their mentoring effectiveness experience on the Six Sigma project team. The data analysis of the interviews included validating the individual responses of the quantitative surveys by comparing the responses from the interviews to the individual questionnaire responses.

Part B and Part C were used to generate themes for each participant. Each open-ended survey response was analyzed to understand the response for the entire population. The themes were used to either validate or refute the results of the quantitative analysis for each participant and each project team. The themes were also used to either validate or refute the data in response to research question R1 that was answered using the results
of the themes drawn from each open-ended question response. Part B and Part C were also used to generate themes for each subgroup (i.e., champions, project leaders, and team members). Each open-ended survey response was analyzed by subgroup to understand the response for each subgroup. The themes were used to either validate or refute the data collected in the quantitative survey for each subgroup. The resulting subgroup themes were also used to either validate or refute the research results in response to the second research question R2.

The initial data were collected from the interviews in a research notebook at the time of the interview and were later transferred to the spreadsheet that was used to collect the quantitative data. The coding procedure of the data as specified in Figure 4 allowed the respondents to be identified for a follow-up interview if a discrepancy existed between the interview and survey answers. Due to the nature of the data collection process, the use of qualitative analysis software was not necessary.

Validity and Reliability

Controls were developed for potential internal and external threats to the statistical validity of the data, data interpretations, data analysis, and the resulting conclusions of the research study. Potential threats to internal validity are addressed in the next section. Such threats could have led to drawing the wrong conclusions from the data (Denzin, 1970; Foreman, 1948). Potential threats to external validity are also discussed that could have threatened drawing the correct conclusion about the generalizability of the research study to other Six Sigma mentoring settings (Denzin; Foreman).
Internal Validity

Potential threats to internal validity could lead to drawing the wrong conclusions from the data (Mathison, 1988). To protect from potential threats to internal validity during data collection, the data collection phase was limited to a two-week period. The threat of maturation was also minimized by the condensed timeline of the study. Regression and selection were not expected to have an effect because the selection of participants was based on individuals’ ability to add value to a Six Sigma project and not due to extreme measures in any one area. The risk of mortality was expected to be minimal due to the condensed timeline, but if participants dropped from the study, they were compared to the participants who remained in the study. Interactions between participants were minimal, but interactions between subgroups were possible. Participants were instructed at the time of the written questionnaire to not to discuss the study with other participants until the study was completed. The study design was expected to capture the interactions between the different subgroups and is discussed in the study results. A control group was not incorporated therefore risks due to effects on a control group did not apply. Administering the written questionnaire to all participants at the same time minimized threats to the study validity. The interviews were conducted within days after the written questionnaire had been administered. Participants were asked to refrain from discussions with other participants until the completion of the final interview in order to reduce the potential risk to internal validity. Procedures to administer the written questionnaire and conduct the interviews were standardized for all participants to reduce risks due to changes in the administration of the instrument.
The data collected were compiled in an Excel spreadsheet and were reviewed for accuracy to ensure that they were entered correctly. Discrepancies in data entries, if any, were researched and corrected. The Excel file was saved in a private database to ensure confidentiality. The notebook and the completed individual questionnaire were stored in a locked cabinet. The data were imported in Excel and analyzed shortly after collection. The Excel file was sent to an independent research analyst for data analysis, and the results were compared to the analysis done by the researcher. This comparison of the interpretative data and analysis ensured an unbiased review of the research results and ensured their validity.

External Validity

Potential threats to external validity could have led to drawing an incorrect conclusion about the generalizability of the research study to other Six Sigma mentoring settings (Mathison, 1988). Potential threats of interactions were anticipated of participants’ selections and the study. The participants and the host company were selected because they closely represented other participants and companies with Six Sigma programs. The survey results are expected therefore to be generalizable across other organizations practicing Six Sigma programs. The study took place in a small to mid-size supply chain and order fulfillment company that practices Six Sigma and is located in a small southern town. Similar results could be expected in other companies practicing Six Sigma in similar settings and in larger companies in other regions. The study results are also expected to apply to other organizations with active Six Sigma programs and apply to companies that implement new Six Sigma programs in the future as long as the program participants have similar training and participate in projects that
are typical of Six Sigma programs. Potential threats to external validity were anticipated in the study design therefore the correct conclusions about the generalizability of the research study can be expected to apply to other Six Sigma mentoring settings.

Summary

The previous two chapters described the fundamental nature of the research study, presented the relevance of the study to the field of leadership, and provided a review of the related literature. Chapter 1 presented the research and defined how Six Sigma mentoring was examined. Chapter 1 also identified why this knowledge is important in order to understand the influence of mentoring on project success. Chapter 2 presented a review of the literature that focused on the dependent variable, project success, and the independent variable, Six Sigma mentoring. The context of the embedded single-case study was identified as a supply chain and order fulfillment company in South Carolina.

Chapter 3 presented a detailed description of the embedded single-case research mixed methods design methodology (Yin, 2003) that explored the effect of mentoring on project success. The data collection instruments were developed with quantitative and qualitative questions and were discussed as the sole instruments for data collection. Chapter 3 also presented a discussion of the appropriateness of this research to the study of leadership, the data analysis plan, and the validity of the research. This study appears to be generalizable and replicable to the study of mentors in organizations and to the study of leadership. The study can be important for leaders of organizations who apply the Six Sigma methodologies and mentoring techniques.

Chapter 4 presents a discussion of the data collection process and data analysis results. The purpose of chapter 4 is to discuss the actual data collection process and the
research study findings. The data collection discussion includes the data collection
procedures, the development of the qualitative survey and interview questions, the pilot
procedures, the gathering of the data, the missing data, the data analysis procedures, and
finally the analysis of the data and findings.
CHAPTER 4: RESULTS

The previous three chapters described the fundamental nature of the research study and its relevance to the field of leadership. They also included a review of the related literature and a description of the design methodology. Chapter 1 presented the research study, defined how the study examined Six Sigma as a modern formal organizational mentor program and identified why this knowledge is important to understand how project success is affected by Six Sigma mentoring. Chapter 2 presented the literature review for the dependent variable, project success, and the independent variable, Six Sigma mentoring. The context of the study was also presented in chapter 2 as the site of a supply chain and order fulfillment company in South Carolina. Chapter 3 presented a detailed description of the research methodology, explained the instruments used to conduct the study, and described the data analysis plan. A discussion on the appropriateness of this research to the study of leadership and the validity of the research was also presented in chapter 3.

Included in chapter 4 is a discussion of the data collection process and data analysis results. The purpose of chapter 4 is to discuss the actual data collection process and the research study findings. The data collection discussion includes the data collection procedures, the development of the quantitative survey and qualitative interview questions, the pilot procedures, the gathering of the data, the missing data, the data analysis procedures, and finally the analysis of the data and findings.

The purpose of this embedded single-case study using a mixed methods design was to explore the influence of mentoring on the success of Six Sigma projects conducted in a supply chain and fulfillment business in the southeastern region of the United States.
Multiple data collection methods used to enhance, validate, corroborate, or refute the data included survey and interview data and a desk study of the project notebooks. The research included the embedded single-case study with a mixed methods design to conduct research at a single organization including more than one unit of analysis (Yin, 2003). In this study, the embedded units were the subgroups associated with the three levels of Six Sigma expertise known as champions, project leaders, and team members. The embedded single-case study design was feasible for this research study because the specific Six Sigma program at the host organization was representative of other Six Sigma programs. From this exploration of Six Sigma mentoring, a list of factors were produced that could potentially enhance future Six Sigma project success. The study explored the influence of the independent variable, mentoring, on the dependent variable, project success, for all the members of the Six Sigma teams who participated on five Six Sigma projects conducted at the organization where this study took place.

This chapter is organized by research question. To study the effects of mentoring on project success and to contribute to current theories, answers to the following two research questions about the overall effectiveness of Six Sigma mentoring and the differences in the effects of mentoring on the participating subgroups were sought:

R1. How does Six Sigma mentoring affect project success in a Six Sigma organization?

R2. How does the effectiveness of mentoring on project success differ for champions, project leaders, and team members?
Data Collection Procedures

This section reviews the actual data collection procedures, the development of intervention during the study, and the quantitative and qualitative surveys used to collect the data. The data collection procedures section also includes a discussion of the pilot study used to test and validate the surveys, the gathering of the data using a research notebook and Excel spreadsheet, and the missing data due to the unavailability of participants or unanswered questions. Finally, the organization of the analysis of the data and findings is introduced.

Interventions

The survey instruments were developed by preparing a quantitative questionnaire and a list of qualitative interview questions using the results of the literature review. The literature review was used to formulate statements for the quantitative survey so that the participants could rate each statement using a Likert-type rating method for how strongly the statement reflected their experience with Six Sigma mentoring and project success.

Quantitative Survey

The quantitative survey (Appendix A) was developed using the results of the literature review of Six Sigma mentoring on project success. The survey was designed with Part A to develop a participant description, Part B for project success, and Part C for mentoring effectiveness. The written quantitative survey included 64 questions. Part A included profile type questions including age, gender, job function, education, project experience, the project team in which the participants were members, and the participants’ role on the team. Questions 8 and 9 were asked in order to place them into a subgroup of Six Sigma participation, champions, project leaders, or team members and to
place them on a specific team to establish the coding of the participants. The subgroups were used in the data analysis as a basis for comparison of each subgroup’s experience with Six Sigma mentoring.

Part B included questions about the participants’ experience with project success. The first four questions inquired about the success of the specific project objectives, meeting the project plan timeline, long-term sustainability of the project accomplishments, and the overall success of the project. Twenty statements followed these questions and addressed project success based on the literature review of the dependent variable. The statements were rated using a Likert-type rating scale. The results were used to determine the level of project success for each project and to determine the participants’ experience with the project success.

Part C included questions about the participants’ experience with Six Sigma mentoring. Three questions asked about the participants’ experience as mentors or mentees. These questions were followed by 27 statements regarding effectiveness of mentoring based on the literature review of the independent variable. The statements were rated using a Likert-type rating scale. The results were used to determine the effectiveness of Six Sigma mentoring for each participant and to determine the participants’ experience with the mentoring.

Qualitative Survey

Using the literature review of the dependent and independent variables, questions were developed for the qualitative portion of the study that corresponded with the survey questions. The qualitative interview questions are referenced in Appendix B. The interview questions were divided in the following three sections: Part A to categorize the
participant into subgroup and project team, Part B for inquiring about project success, and Part C for inquiring about mentoring effectiveness. One question for each main topic was developed for the effects of Six Sigma mentoring on project success as examined in this study, totaling 13 questions for each interview. As in the quantitative survey, the qualitative participants were also categorized into subgroups by Six Sigma participation as champions, project leaders, or team members. The subgroups were used in the data analysis as a basis to compare each subgroup’s experience with Six Sigma mentoring. Each participant was interviewed using the interview questions in Appendix B. Responses were recorded in a field notebook. Confidentiality of the recorded responses was maintained.

Gathering of Data

The research study data were collected in two phases. In the first phase, the survey and interviews were administered to a pilot group. After the pilot group participants completed the survey and interview, they were asked to provide feedback on the questions and on the administration processes used to conduct the study. The feedback was used to improve and revise the survey and study administrative procedures. In the second phase, the survey and interviews were administered to the remaining participants using the revised survey and improved administrative procedures.

Pilot Study

The survey was administered to a pilot group to ensure that the questions were clear and precise. The pilot survey was conducted following research approval from the Institution Review Board. To randomly select the pilot test group, all team numbers 1 through 5 were placed in a hat, and one team name was drawn. Project Team 5 was
randomly selected to pose as the pilot test group and represented 20% of the sample. There were six team members on this team, one champion, one project leader, and four team members. The interview questions were also piloted with the same project team. In addition, the respondents were asked to provide feedback regarding the survey itself and the administration techniques. The feedback was used to improve and revise the survey and study administrative procedures. The feedback from the respondents was used to validate the survey and modify questions in order to improve the overall validity of the survey. Several minor improvements were made to the research study and administration of the study based on the pilot group’s comments. One pilot participant had difficulties with the vocabulary used in Questions 53 and 55. These two questions were reworded for clarity.

Pilot study Question 53 stated, “The Six Sigma program was effective in providing more career opportunities.” The words or job were added to the statement in the full study question to state, “The Six Sigma program was effective in providing more career or job opportunities.” A two-sample $t$-test was used to make inferences about the difference between two population means based on data from two independent samples. The two-sample $t$-test was performed on results from Question 53 to compare the pilot group’s result to the remaining population’s results. A $p$-value of less than or equal to 0.05, representing a 95% confidence level in drawing the correct conclusion from the data analysis, would signify that a difference existed between the two samples. The two-sample $t$-test result for Question 53 of $p$-value = 0.513 signifies that there is no difference between the two samples (Figure 5). The boxplot of this analysis is a graphical display of the two samples and demonstrates that the means of the two samples represents the same
Population at a 95% confidence level. Based on this analysis, the change to Question 53 between the pilot study and the full research study was minimal and did not impact the study results.

Figure 5. Question 53 boxplot comparing the pilot sample project Team 5 to the remaining sample project Teams 1, 2, 3, and 4.

Pilot study Question 55 stated, “The Six Sigma program was effective in providing increased job security.” The statement was restated for clarification in the full study question to state, “The Six Sigma program was effective in helping me feel more secure in my job.” The changes to the two questions between the pilot study and the full research study was minimal and did not impact the study results. The two-sample $t$-test was performed on the results to Question 55 to compare the pilot group’s result to the remaining population’s results. The two-sample $t$-test result for Question 55 of $p$-value = 0.216 signifies that there is no difference between the two samples (Figure 6). The
boxplot of this analysis is a graphical display of the two samples. It demonstrates that the means of the two samples represent the same population at a 95% confidence level. Based on this analysis, the change to Question 55 between the pilot study and the full research study was minimal and did not impact the study results.

![Boxplot of T5 versus T1-4](image)

*Figure 6. Question 55 two-sample t-test results comparing the pilot sample project Team 5 to the remaining sample project Teams 1, 2, 3, and 4.*

The feedback from the pilot group members was used to introduce more clarity in the administration of the study. Two pilot participants had difficulties because they did not read the directions included in the study. There were also some difficulties in scheduling the time for the interviews with some participants. To improve communication, letters were sent electronically to the research participants and were changed to include the statements “Read directions carefully,” and “Call as soon as you
complete the survey.” The electronic letters used for the pilot test group and remaining research participants are available in Appendix E.

Data Depository

The data were gathered over five days. The pilot study data were gathered for two days, and the full study data were collected over three days. The data included collecting the written surveys by electronic transmissions and hard copies from participants. The electronic letters and survey attachments were saved electronically into a file folder. Each survey result was recorded on one spreadsheet with the participant code as the column heading and the question number as the row heading. Participant codes were used to maintain participant confidentiality. Interviews were conducted by telephone, and the responses to each interview question were transcribed into a research notebook. The responses were later recorded into the same spreadsheet as the survey results for each participant. This spreadsheet was the main depository of all survey and interview data collected.

Missing Data

Data were missing from four participants. One participant was a team member to project Team 2 but had left the company over a year before this study and could not be located. Three participants, one from project Teams 3, 4, and 5 respectively responded to the survey request that they did not realize they were on these teams. Additional investigation revealed that the team membership had changed since the team charter was written at the beginning of the project. Due to their lack of project knowledge, these three participants were not included in the research study. This change in participant population had a negligible impact on the team results because they were listed as team
members on different teams. With regards to addressing research question R1, this change was minimal because the data were averaged among all respondents, and the missing data were evenly distributed on four different teams.

ANOVA was used to compare multiple sample means in order to determine whether they differed significantly from each other beyond what would be expected by chance. The $p$-value was used to determine the probability of making a Type I (alpha) error that defines the potential for drawing the wrong conclusions from the statistical analysis during testing. The $p$-value used in this study to determine statistical significance was 0.05, representing a 95% confidence level in drawing the correct conclusion from the data analysis. This potential is called the risk of making an error. The data were interpreted using the $p$-value where a value of less than 0.05 meant that the sample data tested were not part of the compared populations, and the difference between populations was statistically significant (Breyfogle, 2003). A $p$-value of less than 0.05 meant that there was a difference between the samples (Breyfogle), or subgroups in the case of this study. A $p$-value of greater than 0.05 meant that there was no difference between the populations tested (Breyfogle).

The five teams were compared using one-way ANOVA to compare the population means for each question in the survey and interview. The one-way ANOVA for the quantitative survey resulted in a $p$-value = 0.728, which signifies that there was no difference between the five samples (Figure 7).
The qualitative data were converted to numerical data to generate the qualitative ANOVA analysis results. Each statement was converted to a positive one (+1) for positive statements and negative one (-1) for negative statements. The one-way ANOVA for the qualitative interview resulted in a \( p-value = 0.069 \), signifying that there was no difference between the five samples (Figure 8).
Figure 8. Boxplot results comparing the interview question means for the five project teams.

For research question R2, the subgroup team members was the largest of the subgroups with 21 participants, more than four times the size of the other subgroups that included five champions and five project leaders. The missing data had minimal impact, if any, to this subgroup because of its large size. The one-way ANOVA results comparing the quantitative survey question meant for the three subgroups, champions, project leaders, and team members had a $p$-value of 0.411, which signifies that there was no difference between the three samples (Figure 9). The one-way ANOVA results comparing the qualitative interview question meant for the three subgroups, champions, project leaders, and team members had a $p$-value of 0.898, which signifies that there was no difference between the three samples (Figure 10).
Figure 9. Boxplot results comparing the quantitative survey question means for the three subgroups, champions, project leaders, and team members.

Figure 10. Boxplot results comparing the qualitative interview question means for the three subgroups, champions, project leaders, and team members.
Organization of the Analysis

The research study data analysis was organized by presenting a general analysis of the participants’ profile followed by a general summary of each research question and an analysis of the data for each research question. Each research question was examined using triangulation of the data. The study design incorporated an embedded single-case study using a mixed methods design to conduct research with overlapping triangulation of quantitative and qualitative data collection methods. With the triangulation design, quantitative and qualitative data were collected and the results were merged to better understand the research problems. Overlapping triangulation was employed, as proposed by Neuman (2003), to enhance confidence in the results by cross-referencing research questions using both quantitative and qualitative inquiry methods (Denzin, 1970; Foreman, 1948; Mathison, 1988; Merriam, 1998).

Each participant electronically received a questionnaire with a 5-point Likert-type scale that generated quantitative data and was also interviewed to generate qualitative data. Each data collection method (quantitative and qualitative) was designed so that the data from the three subgroups could be triangulated using the two research methods. Two forms of triangulation, data and methodological, were used to collect and analyze the research results. The multiple forms of triangulation provided a clear picture of the effectiveness of mentoring on project success for each subgroup.

Triangulation of the data was designed into the research methodology to validate or refute the findings. Research question R1 used methodological triangulation by comparing the quantitative results to the qualitative results and data triangulation by comparing the results for the five project teams. Research question R2 used
methodological triangulation by comparing the quantitative results to the qualitative results and data triangulation by comparing the results for the three subgroups, champions, project leaders, and team members.

Findings

In this section, the research study data analysis is organized by presenting an analysis of the participants’ profile followed by a general summary of each research question and an analysis of the data for each research question. Each research question is examined using triangulation of the data. The findings are organized by research questions. Each research question is restated and the content of the analysis described. For each research question, a graphic presentation of the findings is provided. A summary of the most important points of the graphic presentation and the most noteworthy findings are provided.

Participant Profile

Questions were included in the quantitative survey to define the participants’ profile and find potential confounding variables. Part A included profile type questions including age, gender, job function, education, project experience, the project team in which the participants were members, and the participants’ role on the team. A question was asked for the purpose of placing the participants into a subgroup of Six Sigma participation, champion, project leader, or team member and to place them on a specific team to establish the coding of the participant. Subgroups were used in the data analysis as a basis for comparison of each subgroup’s experience with Six Sigma mentoring. The results to Part A of the quantitative survey, Questions 1 through 9 are listed in Appendix F.
To account for potential confounding variables, an analysis of the participants’ profile questions in the quantitative survey Part A, Questions 1 through 7, was performed to see whether there were differences in the way people answered when compared to other profile groups (i.e., age, gender, job position, education, and project management experience). For example, this analysis examined whether male participants answered differently from female participants on project success questions and mentoring effectiveness questions. Only the quantitative data were analyzed to examine this difference. ANOVA analysis was used to test for differences in the average team response for project success survey questions in Part B, Questions 14 through 33, and mentoring effectiveness survey questions in Part C, Questions 38 through 64. All the ANOVA analysis resulted in $p > 0.05$, where the differences in means are not statistically significant.

ANOVA analysis resulted in a $p$-value of greater than 0.05 for project success for all analyses when sorted by the participants’ profile where the differences in means are not statistically significant. ANOVA analysis also resulted in a $p$-value of greater than 0.05 for mentoring effectiveness when sorted by the participants’ profile. The analysis determined that the participants’ profile did not result in a statistically significant difference in the response for mentoring effectiveness (Table 4). The profile analysis results indicate that different age groups, different genders, different job positions, different education levels, and different project management experience, had negligible impact on the study results therefore were not interfering variables with the study results of R1 and R2.
Table 4

ANOVA Results Comparing the Participants’ Profile Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Age</th>
<th>Gender</th>
<th>Job</th>
<th>Education</th>
<th>Sponsor</th>
<th>Leader</th>
<th>Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Success</td>
<td>0.462</td>
<td>0.171</td>
<td>0.592</td>
<td>0.096</td>
<td>0.225</td>
<td>0.519</td>
<td>0.516</td>
</tr>
<tr>
<td>Mentoring</td>
<td>0.637</td>
<td>0.209</td>
<td>0.441</td>
<td>0.283</td>
<td>0.715</td>
<td>0.683</td>
<td>0.766</td>
</tr>
</tbody>
</table>

ANOVA was used to test for variation in project success for the five project teams by averaging the results of Questions 14 through 33 for each team member, grouping the results for each team, and comparing the team results using the AVOVA test for variance. The extent of project success for the accumulated Six Sigma projects and the success of individual projects was clear. ANOVA was used to test whether the project success means of the five teams were equal or not equal. The ANOVA results determined that the means were equal, and that there was no difference between the five teams with a \( p \)-value = 0.902. The means of each team are clearly within the population range of the other teams, signifying no statistically significant difference exists between teams even though Teams 1 and 5 had the highest average and Team 3 had the lowest average for response to project success (Figure 11).

HOV was used to test for variation in mentoring effectiveness for the five project teams by averaging the results of Questions 38 through 64 for each team member, grouping the results for each team, and comparing the team results using the AVOVA test for variance. The ANOVA results determined that the mentoring effectiveness means were not statistically different between the five teams with a \( p \)-value = 0.428. The means of each team are clearly within the population range of the other teams, signifying no statistically significant difference exists between teams even though Teams 1 and 5 had
the highest average and tightest distribution of the five teams, and Team 3 had the lowest average with the widest distribution (Figure 12).

Figure 11. Boxplot diagram of the project success means of the five teams.

Figure 12. Boxplot diagram of the mentoring effectiveness means of the five teams.
The comparative analysis of responses for project success and mentoring effectiveness from Teams 1 and 5 had the highest average and Team 3 had the lowest average for responses to questions regarding project success and mentoring effectiveness. Based on this comparative analysis, it appears that Teams 1 and 5, with a relatively high rating for mentoring effectiveness, also had high rating for project success. In addition, Team 3 with a relatively low rating for mentoring effectiveness also had a low rating for project success. Additional analysis was performed on R1 and R2 to support the team results and build a theory about mentoring effects on project success.

**Findings to Research Question R1**

Research question R1 inquired about the overall effectiveness of Six Sigma mentoring by asking: How does Six Sigma mentoring affect project success in a Six Sigma organization? The independent variable was Six Sigma mentoring and the dependent variable was project success. The relationship between the variables was analyzed by comparing the results of the surveys, Part B for project success and Part C for Six Sigma mentoring. This research question was answered using descriptive and inferential statistics, including ANOVA analysis for each question response and correlation analysis between mentoring and project success. Using the assigned values for the survey answers, each survey question was analyzed to understand the response for the entire population and for each project team.

*Research question R1 analysis of project success.* Project success was analyzed by comparing the descriptive statistics for the entire sample and by comparing the mean of each project team. Questions 10 through 13 inquired about the success of the specific project objectives, meeting the project plan timeline, long-term sustainability of the
project accomplishments, and the overall success of the project. Descriptive statistics were also completed for project success for each survey question (Appendix G). All four questions had an average rating between 5 (agree) and 4 (somewhat agree). The question that rated the highest when all teams were averaged was question 11: “The project was completed on time as defined by the documented project plan” ($M = 4.69$, $SD = 0.54$).

The same four questions were asked in the interview phase of the research study. Each statement was converted to a positive one (+1) for positive statements and negative one (-1) for negative statements, and the results were averaged across each question. The data were compared using methodological triangulation. The order of rating for the interview results varied as compared to the survey results (Appendix G). The order of rating for the most successful project was compared using methodological triangulation by comparing the quantitative results for the sum of means to the qualitative results (Table 5). For both analyses, Team 2 was rated the lowest for meeting the project objectives.

Table 5

<table>
<thead>
<tr>
<th>Team</th>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
<th>Team 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey Sum of Means</td>
<td>18.00</td>
<td>16.60</td>
<td>18.75</td>
<td>18.75</td>
<td>18.00</td>
</tr>
<tr>
<td>Interview Sum of Means</td>
<td>3.00</td>
<td>2.20</td>
<td>2.50</td>
<td>2.50</td>
<td>3.80</td>
</tr>
</tbody>
</table>

Twenty statements based on the literature review of the dependent variable were developed to describe the attributes of project success. The participants rated the statements using a Likert-type rating scale with a range from 1 (disagree) to 5 (agree). Descriptive statistics for each survey question included mean, median, standard deviation, variance, and range (Appendix G). The project success questions were sorted
from highest to lowest by average rating. When the average rating was equal between two or more questions, the data were sorted by the lowest to the highest standard deviation. The project success questions were ranked in order of average rating (Figure 13). Each question was based on a project success attribute discussed in the literature review in chapter 2. “A Pareto analysis is the process of ranking opportunities to determine which of many potential opportunities should be pursued first” (Pyzdek, 2003, p. 259). Pareto analysis is the process of separating the vital few process success attributes from the trivial many so that resources can be applied where the greatest impact on return can be realized. The Pareto principle, also known as the 80/20 rule, was developed by Juran (1974) and was applied by ranking all the process success attributes by average rating and identifying the top 20% of the process success attributes that account for 80% of the process success.

![Figure 13. Rank order of process success questions.](image)

The project success attributes that rated the highest and ranked in the top 20% included (a) the customers’ definition of quality as defined by the key critical-to-quality
measures; (b) project schedule plans; (c) critical success factors for project management; (d) management support; and (e) organizational infrastructure including training, tools, and mentor-type human relationships. Based on these results, mentors, project sponsors, and project leaders could use these top five attributes of project success as a strategy to enhance project success. Organizational leaders using focused scorecards to measure project success could develop measures for these top project success attributes.

Research question R1 analysis of mentoring effectiveness. Mentoring effectiveness was analyzed by comparing the descriptive statistics for the entire sample and by comparing the mean of each project team. The first four questions, 34 through 37, inquired about the participants’ experience as mentors and mentees and provided insight to the participants’ previous experience before participating on the Six Sigma project. Approximately two-thirds had had previous experience as mentors and mentees in their personal life or career, but only 48.1% had ever been involved in any form of project mentoring in their career (Appendix G). The quantitative data were triangulated to the qualitative interview data to compare responses, and the results were similar. Question 8 of the interview asked participants to describe their mentoring experiences as mentors and mentees before participating in a Six Sigma project team, and 59.3% of the participants responded that they had had some form of mentoring experience.

Twenty-seven statements based on the literature review of the independent variable were developed to describe the Six Sigma mentoring experience. The participants rated the statements using a Likert-type rating scale ranging from 1 (disagree) to 5 (agree). Descriptive statistics for each survey question included mean, median, standard deviation, variance, and range (Appendix G). The mentoring experience
questions were sorted from highest to lowest by average rating. When the average rating was equal between two or more questions, the data were sorted by the lowest to the highest standard deviation.

The Six Sigma mentoring effectiveness questions were ranked in order of average rating (Figure 14). Each question was based on a mentoring effectiveness attribute discussed in the literature review in chapter 2. The Pareto principle was applied by ranking all the mentoring effectiveness attributes by average rating and identifying the top 20% of the mentoring effectiveness attributes as rated by the participants.

![Figure 14. Rank order of mentoring effectiveness questions.](image)

The mentoring effectiveness attributes that rated the highest and ranked the top 20% included (a) showing an interest in the employee; (b) contributing to project success; (c) providing confirmation and acceptance within the organizational culture; (d) having protégés benefit from their mentors’ knowledge, experience, and status; and (e) having the levels of expertise act as a support structure for the project teams.
Five questions were asked about Six Sigma mentoring effectiveness in the qualitative interview phase of the research study. Each statement was converted to a positive one (+1) for positive statements and negative one (-1) for negative statements, and the results were averaged across each question. The data were compared using methodological triangulation between the interview results compared to the survey corresponding question results. The order of rating for the interview results varied as compared to the survey results of the corresponding question (Appendix G). The top rating question of the qualitative survey, “Describe how you personally benefited or did not benefit from the mentor relationship provided by the Six Sigma infrastructure”, confirms the results of the highest ranking quantitative survey question, “The mentor (champion, master black belt, or project leader) showed an interest in the employees that participated on project teams”, with the top mentoring effectiveness attribute as “Showing an interest in the employee”.

The quantitative survey resulted in identifying the top five mentoring attributes for mentoring effectiveness. The qualitative survey confirmed the results for the top attribute on the quantitative results. Based on these results, mentors, project sponsors, and project leaders could use these top five attributes of mentoring effectiveness to develop their skills in mentoring. Organizational leaders using formal mentoring programming could use these attributes to enhance their mentoring program. Organizations that engage in project management and do not utilize mentoring would benefit significantly from implementing a mentoring infrastructure to support their project management initiatives.

Correlation between mentoring and project success. Correlation analysis was used to understand the relationship between Six Sigma mentoring and project success.
The effects of Six Sigma mentoring for the entire participant population and the success of individual projects were understood by testing for a correlation between project success and Six Sigma mentoring. To test for correlation between the two variables, graphed on the y-axis was the project success response variable and graphed on the x-axis was the Six Sigma mentoring predictor variable. The quantitative result for the Pearson correlation coefficient for this relationship is 0.407, signifying a positive correlation between mentoring and project success. The $p$-value $= 0.035$ for this relationship means that there is a statistically significant relationship between mentoring and project success.

A sequential analysis of variance was performed to understand if the relationship was linear or quadratic. The linear relationship was statistically significant with $p$-value $= 0.035$. The quadratic relationship was not statistically significant with $p$-value $= 0.286$. This means that, as mentoring effectiveness changes, project success also changes in the same direction in a linear type relationship.

The fitted line plot is a regression line used to understand a linear relationship and the degree that mentoring effects project success, and it was used to examine the relationship between the response variable project success ($y$) and the predictor variable mentoring ($x$). The project success responses for Questions 14 through 33 were averaged to get the $y$ data point, and the mentoring effectiveness responses for Questions 38 through 64 were averaged to get the $x$ data point for each participant. The paired data points were analyzed using linear regression analysis and plotted on the fitted line plot (Figure 15). Each dot on the fitted line plot represents one participant. The regression analysis predictor equation for project success was $(y) = 2.882 + 0.2332 (x)$. The $R$ and adjusted $R$-values represented the proportion of variation in the response data project
success (y) explained by the predictors mentoring (x). R (R-Sq) described the amount of variation in the observed response values that was explained by the predictor(s). For the mentoring to project success data, 16.6% of the variation in project success is explained by mentoring. The adjusted R (R-Sq(adj)) took into account the fact that R tended to overestimate the actual amount of variation accounted for in the population. This means that, when one applies the regression equation derived from one sample to another independent sample, one almost always gets a smaller $R$ in the new sample than in the original. For the mentoring to project success data, the adjusted R is 13.3%.

\[
\text{Fitted Line Plot}
\]

\[
Y \text{ Project Success} = 2.882 + 0.2332 \times X \text{ Mentoring}
\]

\[
\begin{array}{cc}
S & 0.297597 \\
R-Sq & 16.6\% \\
R-Sq(adj) & 13.3\%
\end{array}
\]

*Figure 15.* Fitted line plot between the response variable project success (y) and the predictor variable mentoring (x).

To compute the correlation for the qualitative results, each data statement was converted to positive one (+1) for positive statements and negative one (-1) for negative statements. The qualitative results for the Pearson correlation coefficient for this relationship was 0.431, signifying a positive correlation between mentoring and project
success. The \( p \)-value = 0.025 for this relationship means that there is a statistically significant relationship between mentoring and project success, validating the results found in the quantitative analysis.

The correlation analysis between the response variable project success (\( y \)) and the predictor variable mentoring (\( x \)) of the quantitative data by team validated the correlation analysis conducted on the entire sample (Table 6). The results from each team indicate a positive correlation coefficient, signifying a positive correlation between mentoring and project success. Teams 4 and 5 had a very high correlation coefficient, which means that these two teams had a strong positive linear relationship between mentoring effectiveness and project success. The team correlation analysis validates the results of the quantitative and qualitative analysis using data triangulation that there is a statistically significant relationship between mentoring and project success, and as mentoring effectiveness increases, project success also increases.

Table 6

<table>
<thead>
<tr>
<th>Project Team</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Average of Teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative Correlation Coefficient</td>
<td>0.456</td>
<td>0.496</td>
<td>0.78</td>
<td>0.923</td>
<td>0.954</td>
<td>0.721</td>
</tr>
</tbody>
</table>

*Findings to Research Question R2*

Research question R2 inquired into the differences between how mentoring affects project team subgroups, champions, team leaders, and team members. Research question R2 asked: How does the effectiveness of mentoring on project success differ for the three subgroups? The data were grouped into three data sets, champions, project
leaders, and team members. Project success Questions 14 through 33 and mentoring
effectiveness Questions 38 through 64 were analyzed by comparing the descriptive
statistics, mean and standard deviation, for each subgroup (Appendix H). This research
question R2 was also answered using ANOVA to examine the relationship between the
multiple sample variations and compare the subgroups to each other for the individual
responses to the survey questions. The data were analyzed to understand the attributes of
mentoring that most affected the project success for each subgroup.

The descriptive statistics results for each subgroup were analyzed for each
question for project success and mentoring effectiveness (Appendix H). In the project
success analysis, the champions rated the highest means ($M = 4.53$), then the project
leaders ($M = 4.44$), and last the team members ($M = 4.36$). In the mentoring effectiveness
analysis, the project leaders rated the highest means ($M = 4.25$), then the champions ($M =
4.5$), and last the team members ($M = 4.24$). Each subgroup had an average rating
between 5 (agree) and 4 (somewhat agree) for project success and mentoring
effectiveness.

ANOVA was used to test whether the means of the three subgroups had a
statistically significant difference. Two ANOVA analyses were completed for project
success and mentoring effectiveness (Appendix H). The first tested for a variance
between subgroups for the project success quantitative data and qualitative data. The
project success ANOVA analysis for the quantitative data resulted in a $p$-value = 0.372,
and the qualitative data resulted in a $p$-value = 0.876. These results indicate that there is
no statistically significant difference in the project success of the three subgroups for both
data sets. The second ANOVA tested for a variance between subgroups for the mentoring
effectiveness quantitative data and qualitative data. ANOVA analysis for the quantitative data resulted in a $p$-value = 0.155, and the qualitative data resulted in a $p$-value = 0.058. These results indicate that there is no statistically significant difference in the project success of the three subgroups for both data sets. Based on the ANOVA analysis, there is no statistically significant difference in the effects of mentoring to project success for the three subgroups.

The data were analyzed to understand the attributes of mentoring and project success that was rated highest by each subgroup. Only the top six rated questions were considered as the top project success criteria based on the ranking of the rating results. The top six project success attributes were identified as rated by each subgroup champions, project leaders, and team leaders (Appendix I). The project success attributes rated in the top six by all subgroups included (a) management supported decisions and changes; (b) project followed a scheduled plan; and (c) the customers’ definition of quality was considered and defined by the key critical-to-quality project measures. The project success attributes rated in the top six by at least two subgroups included (a) the critical success factors were achieved; and (b) organizational politics experienced during the project were successfully negotiated.

The top eight mentoring effectiveness attributes were identified as rated by each subgroup, champions, project leaders, and team leaders (Appendix H). Only the highest-ranking eight questions were considered as the top mentoring effectiveness attributes based on the ranking of the rating results. The mentoring effectiveness attributes rated in the top eight by all subgroups included (a) the mentor showed an interest in the employees that participated on project teams; and (b) the mentor was effective in
contributing to project success. The project success questions rated in the top six by at least two subgroups included (a) The mentors were effective in matching skills when selecting the project teams, (b) the mentor was successful in enabling the learning experiences, (c) the mentors were effective in providing an educational environment conducive to learning, (d) the mentor provided guidance in the development of the project leader in project management, (e) the mentor was effective in preparing individuals for his or her role on a process improvement team, and (f) the Six Sigma program levels of expertise (champion, master black belt, and project leader) act as a support structure for the project teams.

The findings for research question R2 show that there is no difference in the way mentoring affects project success for people regardless of their level of expertise in Six Sigma. Each subgroup rated several of the same questions as the top attributes of mentoring that affected their participation on the project team.

Summary

The summary of findings section is organized by reviewing the participants’ profile analysis followed by a discussion of each research question. Each research question summary includes an introduction to its content, a concluding summary of the most important points of the graphic presentation, and the most noteworthy findings of this research study.

Summary of participants’ profile. The quantitative survey and qualitative interview questions were analyzed to define the participants’ profile, which included age, gender, job function, education, project experience, the project team in which the participants were members, and the participants’ role on the team. The participants were
placed into project teams and into subgroups of Six Sigma participation, champion, project leader, or team member. The subgroup was used in the data analysis as a basis for comparison of each subgroup’s experience with Six Sigma mentoring.

The participants’ profile was determined and was used in the analysis of potential confounding variables to see if there were differences in the way people answered when compared to other profile groups (i.e., age, gender, job position, education, and project management experience). All the ANOVA analyses resulted in $p > 0.05$ where the difference in means was not statistically significant. Based on this analysis, the participants’ profile including age, gender, job position, education, and project management experience did not interfere with the results of the analysis to study the mentoring effectiveness on project success.

Based on this comparative analysis, it appears that the teams with a relatively high rating for mentoring effectiveness also had a high rating for project success. In addition, the team with a relatively low rating for mentoring effectiveness also had a low rating for project success. Additional analysis was performed on R1 and R2 to support the team results and build a theory about mentoring effects on project success.

**Summary of research question R1.** Research question R1 inquired about the overall effectiveness of Six Sigma mentoring by asking: “How does Six Sigma mentoring affect project success in a Six Sigma organization?” The independent variable was Six Sigma mentoring and the dependent variable was project success. The relationship between the variables was analyzed by comparing the results of Part B and Part C of the surveys. Part B of the surveys measured project success, and Part C measured Six Sigma mentoring. This research question was answered using descriptive and inferential
statistics, including ANOVA analysis for each question response and correlation analysis between mentoring and project success. Using the assigned values for the survey answers, each survey question was analyzed to understand the response for the entire population and for each project team.

The project success questions were ranked in order of average rating. Each question was based on a project success attribute discussed in the literature review in chapter 2. The project success attributes that rated the highest and ranked in the top 20% include (a) the customers’ definition of quality as defined by the key critical-to-quality measures; (b) project schedule plans; (c) critical success factors for project management; (d) management support; and (e) organizational infrastructure including training, tools, and mentor-type human relationships.

The Six Sigma mentoring effectiveness questions were ranked in order of average rating. Each question was based on a mentoring effectiveness attribute discussed in the literature review in chapter 2. The mentoring effectiveness attributes that rated the highest and ranked the top 20% include (a) showing an interest in the employee; (b) contributing to project success; (c) providing confirmation and acceptance within the organizational culture; (d) having protégés benefit from their mentors’ knowledge, experience, and status; and (e) having the levels of expertise act as a support structure for the project teams.

The top rating question of the qualitative survey, “Describe how you personally benefited or did not benefit from the mentor relationship provided by the Six Sigma infrastructure,” confirmed the results of the highest ranking quantitative survey question that stated, “The mentor (champion, master black belt, or project leader) showed an
interest in the employees who participated on project teams,” with the top mentoring effectiveness attribute as “Showing an interest in the employee”.

The correlation analysis between the response variable project success (y) and the predictor variable mentoring (x) of the quantitative data by team validate the correlation analysis conducted on the entire sample. The results from each team are a positive correlation coefficient, signifying a positive correlation between mentoring and project success. This means that, as mentoring effectiveness changes, project success also changes in the same direction in a linear type relationship.

Research question R1 asked: “How does Six Sigma mentoring affect project success in a Six Sigma organization?” The most noteworthy finding of this research study in answering R1 is that a positive correlation exists between mentoring effectiveness and project success therefore mentoring has a positive effect on project success. The positive correlation is apparent for the entire sample and for each project team.

*Summary of Research Question R2.* Research question R2 inquired into the differences between how mentoring effects project team subgroups, champions, team leaders, and team members. Research question R2 asked: “How does the effectiveness of mentoring on project success differ for the three subgroups?” The data were grouped into three data sets, champions, project leaders, and team members. Project success Questions 14 through 33 and mentoring effectiveness Questions 38 through 64 were analyzed by comparing the descriptive statistics, mean and standard deviation, for each subgroup. This research question R2 was answered using ANOVA to examine the relationship between the multiple sample variations and compare the subgroups to each other for the
individual responses to the survey questions. The data were also analyzed to understand
the attributes of mentoring that most affected the project success for each subgroup.

The project success attributes rated in the top six by all subgroups included (a)
management supported decisions and changes; (b) project followed a scheduled plan; and
(c) the customers’ definition of quality was considered and defined by the key critical-to-
quality project measures. The project success attributes rated in the top six by at least two
subgroups included (a) the critical success factors were achieved; and (b) organizational
politics experienced during the project were successfully negotiated.

The mentoring effectiveness attributes rated in the top eight by all subgroups
included (a) the mentor showed an interest in the employees that participated on project
teams; and (b) the mentor was effective in contributing to project success. The project
success questions rated in the top six by at least two subgroups included (a) the mentors
were effective in matching skills when selecting the project teams; (b) the mentor was
successful in enabling the learning experiences; (c) the mentors were effective in
providing an educational environment conducive to learning; (d) the mentor provided
guidance in the development of the project leader in project management; (e) the mentor
was effective in preparing individuals for his or her role on a process improvement team;
and (f) the Six Sigma program levels of expertise (champion, master black belt, and
project leader) acted as a support structure for the project teams.

Research question R2 asked: “How does the effectiveness of mentoring on project
success differ for the three subgroups?” The most noteworthy finding of this research
study in answering R2 is that there is no difference in the way mentoring affects project
success for people regardless of their level of expertise in Six Sigma. Each subgroup
rated several of the same questions as the top attributes of mentoring that affected their participation on the project team.

In conclusion, the previous three chapters described the fundamental nature of the research study, presented the relevance of the study to the field of leadership, provided a review of the related literature, and presented a detailed description of the research methodology that explored the effect of mentoring on project success. Chapter 1 presented the research study and defined how the study examined Six Sigma mentoring and identified why this knowledge was important to understand the influence of mentoring on project success. Chapter 2 presented a review of the literature that focused on the dependent variable, project success, and the independent variable, Six Sigma mentoring. The context of the embedded single-case study was identified as a supply chain and order fulfillment company in South Carolina. Chapter 3 presented a detailed description of the embedded single-case research mixed methods design methodology (Yin, 2003). With this methodology, the effect of mentoring on project success was explored using the quantitative survey and the qualitative interview questions as the instruments for data collection. Chapter 3 also presented a discussion of the appropriateness of this research to the study of leadership, the data analysis plan, and the validity of the research.

Included in chapter 4 was a discussion of the data collection process and data analysis results. The purpose of chapter 4 was to discuss the actual data collection process and the research study findings. The data collection discussion included the data collection procedures, the development of the qualitative survey and interview questions, the pilot procedures, the gathering of the data, the missing data, the data analysis
procedures, and finally the analysis of the data and findings. The most noteworthy findings for research question R1 is that a positive correlation exists between mentoring effectiveness and project success and therefore mentoring has a positive affect on project success. The positive correlation is apparent for the entire sample and for each project team. The most noteworthy findings for research question R2 is that there is no difference in the way mentoring affects project success for people regardless of their level of expertise in Six Sigma. Additionally, each subgroup rated several of the same questions as the top attributes of mentoring that affected their participation on the project team.

Chapter 5 presents recommendations based on the data analysis presented in chapter 4 and includes an interpretation of the data results, inferences about the important findings, a reporting of the lessons learned, and connections between the results of the analysis and implications for leadership. Chapter 5 also includes personal interpretations, reflections, and personal views to broaden the social significance of the findings, and offer recommendations for future research.
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The previous four chapters described the fundamental nature of the research study and its relevance to the field of leadership, provided a review of the related literature, and explained the design methodology, the data collection process, and the data analysis results. The summary of the research problem presented in chapter 1 was that mentoring is not leveraged as a factor to enhance project success. Mentoring has a positive effect on individual performance, and underutilization of mentoring on project success has organizational costs. The return on investment for Six Sigma programs might be greater if mentoring were leveraged as a factor of project success. The purpose of this research study was to explore the influence mentoring has on Six Sigma projects conducted in a supply chain and fulfillment business located in Duncan, South Carolina. From this exploration of Six Sigma mentoring, a list of factors were produced that can potentially enhance future Six Sigma project success. The study was an embedded single-case study doctoral dissertation using a mixed methods design that explored how mentoring affected project success. In this research, the embedded units were the subgroup associated with the three levels of Six Sigma expertise, champions, project leaders, and team members. The research instruments were developed and were used to collect data from the research participants. They included a quantitative survey comprising 64 Likert-type questions and a qualitative interview of 13 open-ended questions.

The study limitations presented in chapter 1 included the number of participants, the survey instruments, and the participants’ previous experience in project teams. Only voluntary participants from the host organization who had participated on a team from the first wave of Six Sigma projects were included in this study. This study was limited to
the number of participants surveyed and the time allotted for conducting the surveys and interviews. The validity of this study was limited to the reliability of the survey instrument and of the interview questions used to examine the relationship of the Six Sigma mentor on the success of the project. The questionnaire was developed and was pretested with a pilot group consisting of one project team. The inquiry into the different experiences of the participants was limited to the actual team project experiences of each individual. Some participants had participated in several non-Six Sigma project teams while others had only participated in Six Sigma teams. Participants were asked to differentiate their experiences on project teams without a mentor from their experience on Six Sigma project teams that had formal mentoring relationships. The questionnaire elicited the number of experiences for each participant on project teams and their role on the project teams.

Conclusions

Chapter 5 presents a larger meaning about the data analysis presented in chapter 4 and includes an interpretation of the data results, inferences about the important findings, a reporting of the lessons learned, and implications for leadership that emerged from the results of the analysis. Additionally, chapter 5 presents personal interpretations, reflections, and views on the broader social significance of the study as well as recommendations for future research. Chapter 5 is organized by first restating the most noteworthy findings of this research and reviewing the importance, significance, and meaning of each research question to the study of leadership and to various constituents who could have an interest in the study results.
This research study adds to the existing body of related literature by expanding on mentoring as a success factor of quality programs used to drive organizational effectiveness. This study is important because it exposes the relationship that mentors have with project teams and examines project success that is attributed to the relationship between mentors and project leaders. The results of the research study added to the modern theories of leadership that evolved from early process-focused quality programs including Six Sigma, Lean Manufacturing, and Lean Sigma. By exposing the effects of mentoring on project leaders, organizational leaders can make greater use of the cultural improvement programs that have coaches, team leaders, and project teams. By expanding the use of mentoring, organizational leaders can also better focus on cultural change, organizational improvement, cost-effectiveness, and process efficiencies.

Significance of Research Question R1

Research question R1 inquired about the overall effectiveness of Six Sigma mentoring by asking: “How does Six Sigma mentoring affect project success in a Six Sigma organization?” The independent variable was Six Sigma mentoring, and the dependent variable was project success. The relationship between the variables was analyzed by comparing the results of the survey that measured project success and mentoring effectiveness. Research question R1 was answered using descriptive and inferential statistics, including ANOVA analysis for each question response and correlation analysis between mentoring and project success to understand the response for the entire population and for each project team.

The project success and mentoring effectiveness attributes that were rated highest by the sample were identified. The project success attributes that rated the highest and
ranked in the top 20% include (a) The customers’ definition of quality as defined by the key critical-to-quality measures; (b) project schedule plans; (c) critical success factors for project management; (d) management support; and (e) organizational infrastructure including training, tools, and mentor-type human relationships. These results are significant to the study of leadership because they identify the attributes of project success that mentors, project sponsors, and project leaders need to focus on to measure a successful project. These results are significant to organizational leaders because they can use the attributes to measure project success and to focus efforts of project management for organizational efficiencies.

The mentoring effectiveness attributes that rated the highest and ranked the top 20% include (a) showing an interest in the employee; (b) contributing to project success; (c) providing confirmation and acceptance within the organizational culture; (d) having protégés benefit from their mentors’ knowledge, experience, and status; and (e) having the levels of expertise act as a support structure for the project teams. These results are significant to the study of leadership because they identify the attributes of mentoring effectiveness that have the most impact on project success. These results are significant to organizational leaders because they can use the attributes to plan and develop mentoring factors in project management programs.

The most noteworthy finding of this research study when answering research question R1 is that a positive correlation exists between mentoring effectiveness and project success therefore mentoring has a positive affect on project success. The positive correlation is apparent for the entire sample and for each project team. The correlation analysis between the dependent variable project success and the independent variable
mentoring of the quantitative data by team validates the correlation analysis conducted on the entire sample. The results from each team indicate a positive correlation coefficient, signifying a positive correlation between mentoring and project success. The fitted line plot was used to understand a linear relationship and was used to examine the relationship between the response variable project success (y) and the predictor variable mentoring (x). For this research study, the regression analysis predictor equation for project success was \( y = 2.882 + 0.2332 \times x \). Based on the study results using this equation, we can conclude that as mentoring effectiveness increases, project success also increases.

The correlation results are significant to the field of leadership because they support the theory that mentoring has a positive impact on individual performance, and as mentoring effectiveness increases, project success also increases. The results also add to the knowledge of leadership by supporting that mentoring has a collective positive impact on organizational project teams. These results are significant to organizational leaders, Six Sigma program administrators, master black belts, and other quality program leaders because they can have an understanding of the importance of effective mentoring on project success. They can also build into their organizational improvement programs an effective mentoring factor that would improve the collective success of projects conducted in their organization and yield improved organizational effectiveness.

Significance of Research Question R2

Research question R2 inquired into the differences between how mentoring effects project team subgroups, champions, team leaders, and team members. Research question R2 asked: “How does the effectiveness of mentoring on project success differ for the three subgroups?” The data were grouped into three data sets, champions, project
leaders, and team members. Project success and mentoring effectiveness were studied by using the descriptive statistics and ANOVA analysis to examine the relationship between the multiple sample variations and compare the subgroups to each other for the responses to the survey questions.

The attributes of mentoring that most affected the project success for each subgroup were identified. The project success attributes that had the highest ranking by subgroups include (a) management supported decisions and changes, (b) project followed a scheduled plan, (c) the customers’ definition of quality was considered and defined by the key critical-to-quality project measures, (d) the critical success factors were achieved, and (e) organizational politics experienced during the project were successfully negotiated. These results confirmed the results of research question R1 and are significant to the study of leadership and to organizational leaders. The results identify the attributes of project success that mentors, project sponsors, and project leaders need to focus on to measure a successful project, and the attributes can be used to measure project success and to focus efforts of project management for organizational efficiencies.

The mentoring effectiveness attributes that had the highest ranking by subgroups include (a) The mentor showed an interest in the employees that participated on project teams, (b) the mentor was effective in contributing to project success, (c) the mentors were effective in matching skills when selecting the project teams, (d) the mentor was successful in enabling the learning experiences, (e) the mentors were effective in providing an educational environment conducive to learning, (f) the mentor provided guidance in the development of the project leader in project management, (g) the mentor was effective in preparing individuals for his or her role on a process improvement team,
and (h) the Six Sigma program levels of expertise (champion, master black belt, and project leader) act as a support structure for the project teams. These results confirm the results of research question R1 and add to the attributes of effective mentoring. These results are significant to the study of leadership because they identify the attributes of mentoring effectiveness that have the most impact on project success. These results are significant to organizational leaders because they can use the attributes to plan and develop mentoring factors in project management programs.

The most noteworthy finding of this research study when answering research question R2 is that there is no difference in the way mentoring affects project success for people regardless of their level of expertise in Six Sigma. Another interesting result is that each subgroup rated several of the same questions as the top attributes of mentoring that affected their participation on the project team. These results are significant to the study of leadership because mentoring affects the project success of all people regardless of their level role on a project team. Therefore, organizational leaders would also find these results significant because they understand the need and importance to employ effective mentoring for all levels in their organizational improvement project management programs.

The most noteworthy findings of this research led to forming a theory on the effects of mentoring on project success. Mentoring has a positive impact on project success, and the more effective the mentoring, the more project success experienced by the team member. Mentoring has a similar effect on all members and levels of expertise of a project team including team sponsors, team leaders, and team members.
Assumptions

This study was based on the following underlying assumptions regarding the attributes of a Six Sigma master black belt. The first assumption was that the master black belt at the host organization had developed the necessary communication, coaching, teaching skills, and Six Sigma program management expertise to be an effective Six Sigma leader. Based on the data collected and the research findings, this assumption appears to be correct. For the theory to be applied to another population of similar characteristics, the mentoring leadership would also need the communication, coaching, teaching skills, and program management expertise to be an effective organizational improvement program leader.

The second assumption was that the participants in the Six Sigma program studied had positive attitudes toward the Six Sigma program. Attitudes are emotions that reflect responses within organizations. The basis for the second assumption was that the general population in the organization studied favorably accepted the Six Sigma culture. Six Sigma is a cultural change and requires a new set of knowledge, skills, and abilities among participants. Based on the data collected and research findings, this assumption appears to be correct for the population studied. For the theory to be applied to another population of similar characteristics, the organizational culture would need to favorably accept the organizational improvement culture.

Limitations

Limitations to the interpretation and applicability of the study results might exist. The reliability of the instruments was discussed for potential limits in the questions used to examine the relationship of the Six Sigma mentor on project success. The size of the
host organization, the maturity of the Six Sigma culture studied, and the application of mentoring in an organization that differs in business type from the host organization might also introduce potential limits to the generalization of the study results.

The study included only voluntary participants who had participated in the Six Sigma program at the supply chain and fulfillment business located in Duncan, South Carolina. This study was limited to the number of participants surveyed and the time allotted for conducting the interviews and surveys. The validity of this study was limited to the reliability of the survey instrument and of the interview questions used to conduct interviews to examine the relationship of the Six Sigma mentor on the success of the project. The questionnaire was developed and was pretested. If it were to be repeated with a similar population, using the same survey and interview instruments, it is expected that the research study would yield similar results.

The inquiry into the different project team experiences of the participants was limited to the actual team experiences of each individual. Some participants had participated in several non-Six Sigma project teams while others had only participated in Six Sigma teams. Participants were asked to differentiate their experiences on project teams without a mentor from their experience on Six Sigma project teams that had formal mentoring relationships. With the questionnaire, the experiences were compared for each participant on project teams, and their role on project teams was compared to their experiences on Six Sigma teams that included mentoring.

The research study was limited to one group of Six Sigma teams and their experience on the Six Sigma team. This allowed for the control of variables that could interfere with the research findings. All participants in each subgroup were subjected to
the same management team, they all had the same project timeline, the impacted parties were of the same organization, and the personnel were assigned to specific teams based on their close association with the process involved in the project. All subgroups were trained on the same technical project tools, all projects were reviewed at the same time and subjected to the same level of feedback, internal and external communication were similar for each team, the organizational politics, environmental events, and project urgency were also the same for all groups. Differences between participants were individual personality traits and individual mentor relationships. Only the relationship of the Six Sigma mentors to the participants’ experience in the program was examined. Studying the mentor relationship to the participants’ experience revealed the kind of impact that mentoring had on project success for the population studied.

Limits to the interpretation of the study results might exist due to the relatively small size of the host organization, the young maturity level of the Six Sigma culture studied, and the specific application of mentoring in an order fulfillment business. The study results might be more applicable to organizations of a similar size and location to the host organization such as small to mid-size companies located in small southern towns and practicing Six Sigma. The study results might not be as applicable to larger organizations due to differences in the depth and breath of Six Sigma implementation.

Organizations with an older maturity level in their Six Sigma culture might find it easier to implement the findings from this study because they have a larger pool of resources available to them. Organizations whose type of business greatly differs from the customer-focused order fulfillment business at the host organization might have difficulties in the application of mentoring throughout the organization. Organizations
that do not focus on customer expectations and requirements might not adapt as easily to the mentoring structure recommended in this research study.

Delimitations

Delimitations to the research study consisted of the specific participants’ profile and the characteristics of the chosen research design. The program participants were chosen for specific characteristics that made them ideal sources of data for this study with a focus on the relationship of Six Sigma mentoring to project success. The participants were project team members in the Six Sigma program at the supply chain and fulfillment business located in Duncan, South Carolina. The participants were able to reflect on their mentoring experiences while participating on a Six Sigma team. Only voluntary Six Sigma program participants were included. This study was limited to the number of participants surveyed and the time allotted for conducting the interviews and surveys. The study took place exclusively at the business located in Duncan, South Carolina.

The embedded single-case study with a mixed methods design included multiple units of analysis (Yin, 2003) and explored the influence of mentoring on project success. The specific research design choice addressed the intended scope of the study and allowed validation of the data gathered by triangulating the data using both quantitative and qualitative methods for three sub-groups. The specific research design allowed a valid comparison of the participants’ reflective experiences with multiple data collection methods. No other design would have fulfilled the goals of the study.
This study was confined to surveying participants in the host organization’s Six Sigma program located in Duncan, South Carolina. This study focused on the relationship of Six Sigma mentoring to project success. Only voluntary Six Sigma program participants were included as participants in the study. The specific research design choice, an embedded single-case study using a mixed methods design was used to address the intended scope of the research study and enabled validation of the data gathered by triangulating the data using both quantitative and qualitative methods for three sub-groups. The specific research design allowed a valid comparison of the participant’s reflective experiences by using multiple data collection methods.

Implications

The research study results have a broad social significance and implications to the application of leadership. The significant and most noteworthy findings of this research aided in the formation of the following new leadership theory: Mentoring has a positive impact on project success, and the more effective the mentoring, the more project success is experienced by the team member. Mentoring has a similar effect on all members and levels of expertise of a project team including team sponsors, team leaders, and team members. This theory can be applied to organizations similar to the organization studied, a supply chain and fulfillment organization in the southeastern United States, and can be used by organizational leaders who want to improve project success in their organization.

The implications to leadership in the organization studied are that effective mentoring increases project success, and mentoring positively impacts all roles on the project team. By improving on the mentoring factor of the Six Sigma program for all roles on the project team, the organization could realize more project success than might
be possible with the current program, yielding a greater impact on organizational success. The organization could also expand the mentoring factor to other aspects of the organization by introducing more leaders and employees in the organization to effective mentoring for their individual and team success.

The research study results could have global implications to leadership theory if the new theory were applied to organizations with improvement programs and organizations that have never had a formal mentoring improvement program. Based on the theory, all organizational leaders should see some form of project success improvement if a formal and effective mentoring program is implemented. Organizational success could be improved for all organizations if formal mentoring were applied to a project improvement program. The collective success of multiple improvement projects could lead to a level of organizational success never previously experienced.

This research study presents a leadership theory that, if applied to organizations, can improve the organizational success of the entire organization. The change to the mentoring and leadership structure in organizations would deliver the intended change. Any company or organization that applies the formal mentoring program could experience the collective success of multiple improvement projects and lead to a level of organizational success that was never previously experienced by the organization. Organizations that have project management without mentoring have the most to gain from applying this leadership theory.
Recommendations

The recommendations presented have broad social significance. The recommendations are presented in two categories: (a) recommendations for action by organizational leaders and the implications that adopting the recommendation of the leadership theory would have on the organization, and (b) recommendations for further study to add to the current leadership body of knowledge. The leadership theory presented is: Mentoring has a positive impact on project success, and the more effective the mentoring, the more project success experienced by the team member. Mentoring has a similar effect on all members and levels of expertise of a project team including team sponsors, team leaders, and team members.

The recommendation to the organization that hosted the study and to other organizations with a formal mentoring improvement program is to review the current Six Sigma mentoring program, strengthen and enhance it, and apply the attributes of mentoring that have the greatest impact on project success. These attributes included (a) showing an interest in the employee; (b) contributing to project success; (c) providing confirmation and acceptance within the organizational culture; (d) having protégés benefit from their mentors’ knowledge, experience, and status; and (e) having the levels of expertise act as a support structure for the project teams. It is also recommended that the organization develop a scorecard for measuring project success using the attributes that were ranked the highest by the research participants. The project success attributes that could be used to develop a project success scorecard included (a) the customers’ definition of quality as defined by the key critical-to-quality measures; (b) project schedule plans; (c) critical success factors for project management; (d) management
support; and (e) organizational infrastructure including training, tools, and mentor-type human relationships.

The recommendation to organizations seeking to implement an improvement program is to design a formal mentoring feature in the improvement program that offers mentoring to all team participants, project sponsors, team leaders, and team members. Applying a mentoring feature to the improvement program will have a greater impact on project success than it would have if mentoring were not designed into the program. The organization will experience a greater impact on project success than it would if no mentoring feature were implemented.

The recommendation for organizations that currently practice project management but do not provide mentoring to their project teams is to implement a mentoring infrastructure for their project teams. Implementing a mentoring infrastructure will provide guidance and motivation to the project leaders and will show more improvements in the organizations’ project success than previously experienced without the mentoring infrastructure. The investment in the mentoring infrastructure will yield a return on investment in both tangible and intangible organizational savings.

The recommendation to enhance the study if it were to be repeated would be to replicate the study on a different sample. Applying the research study to a larger organization could offer interesting results. Organizations that have a more mature Six Sigma mentoring program than the organization studied might also offer interesting results.

This research study was an embedded single-case study doctoral dissertation with a mixed methods design using a pretested instrument to collect qualitative and
quantitative data and explore how mentoring affects project success at an organization in Duncan, South Carolina. The embedded units were the subgroups associated with the three levels of Six Sigma expertise, champions, project leaders, and team members. The findings are that mentoring has a positive impact on project success, and the more effective the mentoring, the more project success is experienced by team members. Mentoring has a similar effect on all members of a project team including team sponsors, team leaders, and team members.

Based on the study results, organizations that engage in project management and do not utilize mentoring would benefit considerably from implementing a mentoring infrastructure to support their project management initiatives. Organizations that have project management without mentoring have the most to gain from applying the leadership theory elaborated as the result of this research. Implementing a mentoring infrastructure will provide guidance and motivation to the project leaders and will show more improvements in the organizations’ project success than previously experienced without the mentoring infrastructure. The investment in the mentoring infrastructure will yield a return on investment in both tangible and intangible organizational savings.
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APPENDIX A: SURVEY INSTRUMENT ONE
Survey Instrument One

Effects Of Six Sigma Mentoring On Project Success Questionnaire

Part A: Participant Description

1) Age (years)
   - 18-24
   - 25-31
   - 32-38
   - 39-45
   - 45-51
   - 52+

2) Gender
   - Male
   - Female

3) Job function
   - Line worker
   - Supervisor
   - Manager
   - Director +

4) What is your highest level of education?
   - 1) High School
   - 2) Professional Certification
   - 3) 1-2 years college
   - 4) 3-4 years college
   - 5) 5+ years college

5) How many projects did you participate on as a team sponsor prior to the Six Sigma project?
   - 0
   - 1-3
   - 4-6
   - 7-10
   - 10+

6) How many projects did you participate on as a team leader prior to the Six Sigma project?
   - 0
   - 1-3
   - 4-6
   - 7-10
   - 10+

7) How many projects did you participate on as a team member prior to the Six Sigma project?
   - 0
   - 1-3
   - 4-6
   - 7-10
   - 10+

8) Check the Six Sigma project in which you participated on the team.
   - Project 1: Scrap Reduction: Examine the causes of scrap, identify and implement processes to reduce the volume and cost of scrap for the manufacturing and warehousing of the Arvato owned Intuit inventory
   - Project 2: Cell Manufacturing: Introduce Cell manufacturing techniques utilizing smaller teams to produce builds of less than 300 units.
   - Project 3: SLA Reporting: Automate the process of manually tracking of release hold dates and offending sku list.
   - Project 4: BOM and Assembly Instruction Accuracy: Eliminate errors in BOM and Assembly Instructions that cause rework, down time in production, and inventory errors.
   - Project 5: Process Inspection Measurement: Identify where the breakdown in Process Inspections is occurring, and eliminating the defects.
9) What was your role on the Six Sigma project team? □ Champion □ Project Leader □ Team Member

Part B: Project Success

Project Success: Project success is based on the accomplishment of the project objectives. Each project leader in conjunction with their project champion determines the project success factors. The project success factors are quantitative measures and are documented in the project charter. Project success is determined by the degree the project objectives were met and the sustainability of project improvement since the project was completed.

Directions: Using the definition of project success answer the following questions about your Six Sigma project experience.

10) The Six Sigma project accomplished the objectives defined in the project charter.
   □ 1. Disagree.
   □ 2. Somewhat disagree.
   □ 3. Undecided.
   □ 4. Somewhat agree.
   □ 5. Agree.

11) The project was completed on-time as defined by the documented project plan.
   □ 1. Disagree.
   □ 2. Somewhat disagree.
   □ 3. Undecided.
   □ 4. Somewhat agree.
   □ 5. Agree.

12) The project accomplishments were sustained and are still in effect since the project completion.
   □ 1. Disagree.
   □ 2. Somewhat disagree.
   □ 3. Undecided.
   □ 4. Somewhat agree.
   □ 5. Agree.

13) I would you rate the overall success of the Six Sigma project that I participated on as successful.
   □ 1. Disagree.
   □ 2. Somewhat disagree.
   □ 3. Undecided.
   □ 4. Somewhat agree.
   □ 5. Agree.
# Measuring Project Success

Rate the following statements by placing a check mark in the left-hand column that best represents your experience.

"The Six Sigma project was successful with the following project success criteria:"

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Undecided</th>
<th>Somewhat agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. The critical success factors were achieved.</td>
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<td></td>
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</tr>
<tr>
<td>15. Management supported decisions and changes</td>
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<tr>
<td>16. Project followed a scheduled plan</td>
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<td></td>
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<tr>
<td>17. Impacted departments and personnel were please with the project outcome.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Project management training was helpful to the project leader.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. The mentor relationship between the Master Black Belt, Champion, or Project Leader and I helped achieve project results.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Technical tasks were accomplished.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Periodic monitoring of the project success, timely feedback, and communication were helpful toward project success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Team leader characteristics were observed and helped achieve project success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Organizational politics experienced during the project were successfully negotiated.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Environmental events experienced during the project were handled in a way that did not interfere with project success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. There was a sense of urgency associated with the project that helped drive success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Project success was defined through several performance measurements that were determined by the company leaders.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Success measures were specific to the process involved and measured the success of the project.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Projects affected the business metrics that have the greatest impact on top management.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. The customers’ definition of quality was considered and defined by the key critical-to-quality project measures.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Modifications were made to the project metrics to reflect the project goals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. Project achieved the process efficiencies and improvement that helped achieve the organization’s desired state.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. The project incorporated cross-cultural methods to achieve organizational change.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Organizational infrastructure including training, tools, and mentor-type human relationships were available and used to achieve project success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part C: Six Sigma Mentor

**Definition of Mentoring.** Mentoring is a nurturing process that aids in the development of a protégé through the use of teaching, coaching, and guidance in the development of a novice in a profession or organization.

**Directions:** Using the definition of mentoring answer the following questions about your mentoring experiences.

**Experience as a Mentor/Mentee**

35) Have you ever had a mentor at anytime during your career? ☐ Yes ☐ No

35) Have you ever had a mentor at anytime in your personal life? ☐ Yes ☐ No

36) Have you ever been a mentor for another person during your career? ☐ Yes ☐ No

37) Have you ever been involved in any other form of project mentoring in your career? ☐ Yes ☐ No

If Yes, please describe the project and the type of mentoring activity.
Effectiveness of Six Sigma Mentoring

Rate the following statements by placing a tick mark in the left-hand column that best represents your experience.

"Six Sigma mentoring was effective to you or by you in your role on the Six Sigma project team in providing the following."

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Undecided</th>
<th>Somewhat agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentoring was effective in helping me to understand the DMAIC process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mentoring was effective in helping me to apply the DMAIC process to the project.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mentoring was effective in helping me to follow the DMAIC project plan.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mentoring was effective in helping me to understand the link between improvement and profitability.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The mentor (Champion, Master Black Belt, or Project Leader) showed an interest in the employees that participated on project teams.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Champion and Master Black Belt were effective in matching skills when selecting the project teams.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The mentor (Champion, Master Black Belt, or Project Leader) was successful in enabling the learning experiences.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Champion and Master Black Belt were effective in providing an educational environment conducive to learning.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Champion, Master Black Belt, or Project Leader provided guidance in the development of the project leader in project management.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Champion, Master Black Belt, or Project Leader was effective in providing a nurturing process that aids in the development of the protégé.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Six Sigma program was effective in benefiting the mentor, team leaders, and the organization.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Champion, Master Black Belt, or Project Leader were paternalistic in nature in providing a role model.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Champion, Master Black Belt, or Project Leader were effective in providing confirmation and acceptance within the organizational culture.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Effectiveness of Six Sigma Mentoring, Continued

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>51.</td>
<td>The protégé benefited from the Champion, Master Black Belt, or Project Leader's knowledge, experience, and status.</td>
<td></td>
</tr>
<tr>
<td>52.</td>
<td>The Six Sigma program was effective in giving an increased visibility to higher-ups, possibly translating to a promotional advantage.</td>
<td></td>
</tr>
<tr>
<td>53.</td>
<td>The Six Sigma program was effective in providing more career or job opportunities.</td>
<td></td>
</tr>
<tr>
<td>54.</td>
<td>The Six Sigma program was effective in providing project leaders with the potential to earn higher pay.</td>
<td></td>
</tr>
<tr>
<td>55.</td>
<td>The Six Sigma program was effective in helping me feel more secure in my job.</td>
<td></td>
</tr>
<tr>
<td>56.</td>
<td>Participation in the Six Sigma program provided recognition in the organization.</td>
<td></td>
</tr>
<tr>
<td>57.</td>
<td>The Six Sigma program was effective in encouraging employees to cooperate in joint team efforts in the organization.</td>
<td></td>
</tr>
<tr>
<td>58.</td>
<td>The Champion, Master Black Belt, or Project Leader was effective in contributing to project success.</td>
<td></td>
</tr>
<tr>
<td>59.</td>
<td>The Champion and Master Black Belt personally and professionally benefited, and experienced advancement as a result of the developing, Project Leader's success.</td>
<td></td>
</tr>
<tr>
<td>60.</td>
<td>Champions, Master Black Belt, or Project Leaders were effective in accumulating power, success, and peer respect.</td>
<td></td>
</tr>
<tr>
<td>61.</td>
<td>Champions, Master Black Belt, or Project Leaders were effective in gaining access to information, both inside and outside the organization, which furthered his or her influence.</td>
<td></td>
</tr>
<tr>
<td>62.</td>
<td>The Six Sigma program was effective in providing benefits of mentoring to the individuals and projects.</td>
<td></td>
</tr>
<tr>
<td>63.</td>
<td>The Champion, Master Black Belt, or Project Leader was effective in preparing individuals for his or her role on a process improvement team.</td>
<td></td>
</tr>
<tr>
<td>64.</td>
<td>The Six Sigma program levels of expertise (Champion, Master Black Belt, and Project Leader) act as a support structure for the project teams.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B: SURVEY INSTRUMENT TWO
Survey Instrument Two
Effects Of Six Sigma Mentoring On Project Success Interview

**Part A: Participant Description**
1) What was your role on a Six Sigma Team? □ Champion □ Project Leader □ Team Member

2) You participated on which Six Sigma project?
   □ Project 1: Scrap Reduction  
   □ Project 2: Cell Manufacturing  
   □ Project 3: SLA Reporting  
   □ Project 4: BOM and Assembly Instruction Accuracy  
   □ Project 5: Process Inspection Measurement

**Part B: Project Success**
3) Describe your project management experience prior to participating on a Six Sigma project team.
4) Describe how the Six Sigma project accomplished the objectives defined in the project charter.
5) Describe how the project was completed on time as defined by the documented project plan.
6) Describe how the project accomplishments were sustained and if they are still in effect since the project completion.
7) How would you rate the overall success of the Six Sigma project in which you participated on.

**Part C: Mentoring Effectiveness**
8) Describe your mentoring experiences (as a mentor and mentee) prior to participating on a Six Sigma project team.
9) Describe how you personally benefited or did not benefit from the mentor relationship provided by the Six Sigma infrastructure.
10) Describe how well the Six Sigma mentoring affected or did not affect your ability to participate on the project team.
11) Describe how well the mentoring infrastructure helped or did not help you navigate barriers as you worked on the project team.
12) Describe how the mentoring aspect of Six Sigma made you more or less successful in your career.
13) Describe how Six Sigma mentoring made you more or less successful on the project team.
APPENDIX C: PERMISSION TO USE PREMISES
UNIVERSITY OF PHOENIX

INFORMED CONSENT: PERMISSION TO USE PREMISES, NAME, AND/OR SUBJECTS
(Facility, Organization, University, Institution, or Association)

Arvato Services, Inc.
Name of Facility, Organization, University, Institution, or Association

I hereby authorize Alice Jeanne Denomme Gobeille, student of University of Phoenix, to use the premises, name and/or subjects requested to conduct a study entitled A Case Study Analysis of the Effects of Six Sigma Mentoring on Project Success.

[Signature] 4-17-06

Vice President of East Coast Operations
Title

Arvato Services, Inc., Duncan, South Carolina
Name of Facility
APPENDIX D: INFORMED CONSENT
Informed Consent Form

UNIVERSITY OF PHOENIX

INFORMED CONSENT: PARTICIPANTS 18 YEARS OF AGE AND OLDER

Dear Research Study Participant,

I am a student at the University of Phoenix working on a Doctorate of Management in Organizational leadership. I am conducting a research study entitled A Case Study Analysis of the Effects of Six Sigma Mentoring on Project Success. The purpose of the research study is to explore how mentoring effects project success by understanding the effect Six Sigma mentoring has on project success for three subgroups, team sponsor, project leader, and team members at Arvato Services located in Duncan, South Carolina.

Your participation will involve completing a written survey and answering open-ended questions in a face-to-face interview. Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, you can do so without penalty or loss of benefit to yourself. The results of the research study may be published but your name will not be used and your results will be maintained in confidence.

In this research, there are no foreseeable risks to you.

Although there may be no direct benefit to you, the possible benefit of your participation could help enhance the leadership body of knowledge for the effectiveness of mentoring on project success in the Six Sigma field of study, by providing participation in a sound research study that observes the effects that Six Sigma mentoring has on project success.

If you have any questions concerning the research study, please contact me.

An anonymous questionnaire will be included in the research study. The return of the completed questionnaire will be considered your consent to participate.

Sincerely,

Alice Jeanne Denomme Gobeille

Alice Jeanne Denomme Gobeille
APPENDIX E: ELECTRONIC LETTERS TO PARTICIPANTS
Dear Six Sigma Team Participant,

The Six Sigma team you participated on was selected to be the pilot group for my dissertation research study. This research study examines the mentoring aspect of being on a Six Sigma team and the effects this had on your team’s project success. As the pilot group I will need you to fill out the attached survey, and give me feedback on the questionnaire itself, so I can make any necessary changes to the questionnaire before I send it to the other participants.

The timing of this study is crucial; therefore I will need your responses within 2 days of receipt. After I get your completed questionnaire I will also use you as the pilot group for the second phase that includes a short one-on-one interview, which takes approximately 10 minutes. All responses will be considered confidential and names will not be shared or used in the written dissertation. The attached file has a list of the projects and the team members. Use this file to identify your team and answer questions 8 and 9. If you were on more than one team please identify each team in question 8. This information will be used to code your data to provide confidentiality.

Please respond by email at agobeille@email.uophx.edu and call me if you need assistance.

I want to thank you in advance for supporting me in this effort.

Printed copies of this message went to team members with no email address.

Beast Regards,

Alice Gobeille

agobeille@email.uophx.edu
Dear Six Sigma Team Participant,

Please read instructions carefully.

This research study examines the mentoring aspect of being on a Six Sigma team and the effects this had on your team’s project success. I will need you to fill out the attached survey. After I get your completed questionnaire I will need to interview you for the second phase that includes a short one-on-one 10 minute interview. Please call me immediately after you complete the survey. The timing of this study is crucial. I will need your written and verbal responses within 2 days of receipt. My goal is to have all surveys and interviews complete by end of day Thursday, 4/27/06.

All responses will be considered confidential and names will not be shared or used in the written dissertation. The attached file has a list of the projects and the team members. Use this file to identify your team and answer questions 8 and 9. If you were on more than one team please identify each team in question 8. This information will be used to code your data to provide confidentiality.

Please do not discuss the contents of this study with other participants until the study is completed.

Please respond by email at agobeille@email.uophx.edu and call me if you need assistance.

I want to thank you in advance for supporting me in this effort.

Printed copies of this message went to team members with no email address.

Best Regards,

Alice Gobeille
APPENDIX F: DATA ANALYSIS OF PARTICIPANT PROFILE
Table 7  

**Question 1: Age of Participants**

<table>
<thead>
<tr>
<th>Age</th>
<th>18 to 24</th>
<th>25 to 31</th>
<th>32 to 38</th>
<th>39 to 45</th>
<th>45 to 51</th>
<th>Over 52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>14.8%</td>
<td>11.1%</td>
<td>29.6%</td>
<td>25.9%</td>
<td>11.1%</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

Table 8  

**Question 2: Gender of Participants**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>44.4%</td>
<td>55.6%</td>
</tr>
</tbody>
</table>

Table 9  

**Question 3: Job Function of Participants**

<table>
<thead>
<tr>
<th>Job Function</th>
<th>Line Worker</th>
<th>Supervisor</th>
<th>Manager</th>
<th>Director+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>25.9%</td>
<td>29.6%</td>
<td>25.9%</td>
<td>18.5%</td>
</tr>
</tbody>
</table>

Table 10  

**Question 4: Highest Level of Education**

<table>
<thead>
<tr>
<th>Education</th>
<th>High School</th>
<th>1-2 years college</th>
<th>3-4 years college</th>
<th>5+ years college</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>14.8%</td>
<td>37.0%</td>
<td>25.9%</td>
<td>22.2%</td>
</tr>
</tbody>
</table>
Table 11

*Question 5: Projects as a Team Sponsor Prior to the Six Sigma Project*

<table>
<thead>
<tr>
<th>Projects</th>
<th>0</th>
<th>1 to 3</th>
<th>4 to 6</th>
<th>7 to 10</th>
<th>10+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>77.8%</td>
<td>7.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>14.8%</td>
</tr>
</tbody>
</table>

Table 12

*Question 6: Projects as a Team Leader Prior to the Six Sigma Project*

<table>
<thead>
<tr>
<th>Projects</th>
<th>0</th>
<th>1 to 3</th>
<th>4 to 6</th>
<th>7 to 10</th>
<th>10+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>74.1%</td>
<td>7.4%</td>
<td>0.0%</td>
<td>11.1%</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

Table 13

*Question 7: Projects as a Team Member Prior to the Six Sigma Project*

<table>
<thead>
<tr>
<th>Projects</th>
<th>0</th>
<th>1 to 3</th>
<th>4 to 6</th>
<th>7 to 10</th>
<th>10+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>25.90%</td>
<td>48.10%</td>
<td>0%</td>
<td>11.10%</td>
<td>14.80%</td>
</tr>
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</table>

Table 14

*Question 8: Number of Team Members per Project Team*

<table>
<thead>
<tr>
<th>Team</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
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</tbody>
</table>
Table 15

*Question 9: Number of Participants in Subgroups*

<table>
<thead>
<tr>
<th>Level</th>
<th>Champions</th>
<th>Team Leaders</th>
<th>Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Members</td>
<td>5</td>
<td>5</td>
<td>21</td>
</tr>
</tbody>
</table>
APPENDIX G: DATA ANALYSIS FOR RESEARCH QUESTION R1
Table 16

*Descriptive Statistics of Project Success Objectives*

<table>
<thead>
<tr>
<th>Survey Question on Project Success</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Variance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. The Six Sigma project accomplished the objectives defined in the project charter.</td>
<td>4.41</td>
<td>5</td>
<td>0.87</td>
<td>0.75</td>
<td>4</td>
</tr>
<tr>
<td>11. The project was completed on-time as defined by the documented project plan.</td>
<td>4.69</td>
<td>5</td>
<td>0.54</td>
<td>0.29</td>
<td>2</td>
</tr>
<tr>
<td>12. The project accomplishments were sustained and are still in effect since the project completion.</td>
<td>4.17</td>
<td>4</td>
<td>1.00</td>
<td>1.00</td>
<td>4</td>
</tr>
<tr>
<td>13. I would you rate the overall success of the Six Sigma project that I participated on as successful.</td>
<td>4.52</td>
<td>5</td>
<td>0.69</td>
<td>0.47</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 17

*Triangulation of Project Success Results*

<table>
<thead>
<tr>
<th>Interview Question on Project Success</th>
<th>Interview Mean</th>
<th>Survey Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Describe how the Six Sigma project accomplished the objectives defined in the project charter.</td>
<td>0.93</td>
<td>4.41</td>
</tr>
<tr>
<td>4. Describe how the project was completed on time as defined by the documented project plan.</td>
<td>0.78</td>
<td>4.69</td>
</tr>
</tbody>
</table>
5. Describe how the project accomplishments were sustained and if they are still in effect since the project completion.

6. How would you rate the overall success of the Six Sigma project in which you participated on.

Table 18

Descriptive Statistics of Project Success Questions

<table>
<thead>
<tr>
<th>Question on Project Success</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Variance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. The critical success factors were achieved.</td>
<td>4.70</td>
<td>5</td>
<td>0.54</td>
<td>0.29</td>
<td>2</td>
</tr>
<tr>
<td>15. Management supported decisions and changes</td>
<td>4.70</td>
<td>5</td>
<td>0.61</td>
<td>0.37</td>
<td>2</td>
</tr>
<tr>
<td>16. Project followed a scheduled plan.</td>
<td>4.88</td>
<td>5</td>
<td>0.33</td>
<td>0.11</td>
<td>1</td>
</tr>
<tr>
<td>17. Impacted departments and personnel were pleased with the project outcome.</td>
<td>4.56</td>
<td>5</td>
<td>0.51</td>
<td>0.26</td>
<td>1</td>
</tr>
<tr>
<td>18. Project management training was helpful to the project leader.</td>
<td>4.67</td>
<td>5</td>
<td>0.68</td>
<td>0.46</td>
<td>2</td>
</tr>
<tr>
<td>19. The mentor relationship between the Master Black Belt, Champion, or Project Leader and I helped achieve project results.</td>
<td>4.59</td>
<td>5</td>
<td>0.75</td>
<td>0.56</td>
<td>2</td>
</tr>
<tr>
<td>20. Technical tasks were accomplished.</td>
<td>4.52</td>
<td>5</td>
<td>0.75</td>
<td>0.57</td>
<td>3</td>
</tr>
<tr>
<td>21. Periodic monitoring of the project success, timely feedback, and communication were helpful toward project success.</td>
<td>4.54</td>
<td>5</td>
<td>0.99</td>
<td>0.98</td>
<td>4</td>
</tr>
<tr>
<td>22. Team leader characteristics were observed and helped</td>
<td>4.59</td>
<td>5</td>
<td>0.57</td>
<td>0.33</td>
<td>2</td>
</tr>
</tbody>
</table>
achieve project success.

23. Organizational politics experienced during the project were successfully negotiated.

24. Environmental events experienced during the project were handled in a way that did not interfere with project success.

25. There was a sense of urgency associated with the project that helped drive success.

26. Project success was defined through several performance measurements that were determined by the company leaders.

27. Success measures were specific to the process involved and measured the success of the project.

28. Projects affected the business metrics that have the greatest impact on top management.

29. The customers’ definition of quality was considered and defined by the key critical-to-quality project measures.

30. Modifications were made to the project metrics to reflect the project goals.

31. Project achieved the process efficiencies and improvement that helped achieve the organization’s desired state.

32. The project incorporated cross-cultural methods to achieve organizational change.

33. Organizational infrastructure including training, tools, and mentor-type human relationships were available and used
to achieve project success.

Table 19

*Experience as a Mentor and Mentee*

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>34) Have you ever had a mentor at anytime during your career?</td>
<td>66.7%</td>
<td>33.3%</td>
</tr>
<tr>
<td>35) Have you ever had a mentor at anytime in your personal life?</td>
<td>63.0%</td>
<td>37.0%</td>
</tr>
<tr>
<td>36) Have you ever been a mentor for another person during your career?</td>
<td>70.4%</td>
<td>29.6%</td>
</tr>
<tr>
<td>37) Have you ever been involved in any other form of project mentoring in your career?</td>
<td>48.1%</td>
<td>51.9%</td>
</tr>
</tbody>
</table>

Table 20

*Descriptive Statistics of Six Sigma Mentoring Experience*

<table>
<thead>
<tr>
<th>Questions on Mentoring Effectiveness</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Variance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>38. Mentoring was effective in helping me to understand the DMAIC process.</td>
<td>4.56</td>
<td>5</td>
<td>0.97</td>
<td>0.95</td>
<td>4</td>
</tr>
<tr>
<td>39. Mentoring was effective in helping me to apply the DMAIC process to the project.</td>
<td>4.59</td>
<td>5</td>
<td>0.93</td>
<td>0.87</td>
<td>4</td>
</tr>
<tr>
<td>40. Mentoring was effective in helping me to follow the DMAIC project plan.</td>
<td>4.56</td>
<td>5</td>
<td>0.93</td>
<td>0.87</td>
<td>4</td>
</tr>
</tbody>
</table>
41. Mentoring was effective in helping me to understand the link between improvement and profitability.

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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.15</td>
<td>5</td>
<td>1.32</td>
<td>1.75</td>
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</table>

42. The mentor (Champion, Master Black Belt, or Project Leader) showed an interest in the employees that participated on project teams.

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</thead>
<tbody>
<tr>
<td></td>
<td>4.85</td>
<td>5</td>
<td>0.46</td>
<td>0.21</td>
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43. The Champion and Master Black Belt were effective in matching skills when selecting the project teams.

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.67</td>
<td>5</td>
<td>0.62</td>
<td>0.38</td>
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</table>

44. The mentor (Champion, Master Black Belt, or Project Leader) was successful in enabling the learning experiences.

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<tbody>
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<td></td>
<td>4.67</td>
<td>5</td>
<td>0.92</td>
<td>0.85</td>
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</tbody>
</table>

45. The Champion and Master Black Belt were effective in providing an educational environment conducive to learning.

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<table>
<thead>
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</thead>
<tbody>
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</table>

46. The Champion, Master Black Belt, or Project Leader provided guidance in the development of the project leader in project management.

<p>| | | | | | |</p>
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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
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<td>5</td>
<td>0.67</td>
<td>0.45</td>
<td>2</td>
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</tbody>
</table>

47. Champion, Master Black Belt, or

<p>| | | | | | |</p>
<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td></td>
<td>4.70</td>
<td>5</td>
<td>0.61</td>
<td>0.37</td>
<td>2</td>
</tr>
</tbody>
</table>
Project Leader was effective in providing a nurturing process that aids in the development of the protégé.

48. The Six Sigma program was effective in benefiting the mentor, team leaders, and the organization.

4.70 5 0.47 0.22 1

49. Champion, Master Black Belt, or Project Leader were paternalistic in nature in providing a role model.

50. Champion, Master Black Belt, or Project Leader were effective in providing confirmation and acceptance within the organizational culture.

51. The protégé benefited from the Champion, Master Black Belt, or Project Leader's knowledge, experience, and status.

52. The Six Sigma program was effective in giving an increased visibility to higher-ups, possibly translating to a promotional advantage.

53. The Six Sigma program was effective in providing more career or
54. The Six Sigma program was effective in providing project leaders with the potential to earn higher pay. 

55. The Six Sigma program was effective in helping me feel more secure in my job.

56. Participation in the Six Sigma program provided recognition in the organization.

57. The Six Sigma program was effective in encouraging employees to cooperate in joint team efforts in the organization.

58. The Champion, Master Black Belt, or Project Leader was effective in contributing to project success.

59. The Champion and Master Black Belt personally and professionally benefited, and experienced advancement as a result of the developing, Project Leader's success.

60. Champions, Master Black Belt, or
Project Leaders were effective in accumulating power, success, and peer respect.

61. Champions, Master Black Belt, or Project Leaders were effective in gaining access to information, both inside and outside the organization, which furthered his or her influence.

62. The Six Sigma program was effective in providing benefits of mentoring to the individuals and projects.

63. The Champion, Master Black Belt, or Project Leader was effective in preparing individuals for his or her role on a process improvement team.

64. The Six Sigma program levels of expertise (Champion, Master Black Belt, and Project Leader) act as a support structure for the project teams.

Table 21

*Triangulation of Interview Question Results to the Survey Questions*
<table>
<thead>
<tr>
<th>Interview Question on Project Success</th>
<th>Corresponding Survey Questions</th>
<th>Interview Mean</th>
<th>Survey Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Describe how you personally benefited or did not benefit from the mentor relationship provided by the Six Sigma infrastructure.</td>
<td>38-41</td>
<td>0.78</td>
<td>4.46</td>
</tr>
<tr>
<td>10 Describe how well the Six Sigma mentoring affected or did not affect your ability to participate on the project team.</td>
<td>42-43</td>
<td>1.00</td>
<td>4.76</td>
</tr>
<tr>
<td>11 Describe how well the mentoring infrastructure helped or did not help you navigate barriers as you worked on the project team.</td>
<td>45-47</td>
<td>1.00</td>
<td>4.70</td>
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<tr>
<td>12 Describe how the mentoring aspect of Six Sigma made you more or less successful in your career.</td>
<td>51-56</td>
<td>0.78</td>
<td>3.69</td>
</tr>
<tr>
<td>13 Describe how Six Sigma mentoring made you more or less successful on the project team.</td>
<td>61-64</td>
<td>1.00</td>
<td>4.55</td>
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</tbody>
</table>
APPENDIX H: DATA ANALYSIS FOR RESEARCH QUESTION R2
Table 22

*Project Success Mean and Standard Deviation, for Each Subgroup*

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Champion Mean</th>
<th>Champion Standard Deviation</th>
<th>Project Leader Mean</th>
<th>Project Leader Standard Deviation</th>
<th>Team Members Mean</th>
<th>Team Members Standard Deviation</th>
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<tr>
<td>14</td>
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<td>0.45</td>
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<td>3.89</td>
<td>1.28</td>
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</table>
### Table 23

*Mentoring Mean and Standard Deviation, for Each Subgroup*

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Champion Mean</th>
<th>Champion Standard Deviation</th>
<th>Project Mean</th>
<th>Project Standard Deviation</th>
<th>Leader Mean</th>
<th>Leader Standard Deviation</th>
<th>Yellow Belt Mean</th>
<th>Yellow Belt Standard Deviation</th>
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<td>0.00</td>
<td>4.58</td>
<td>0.69</td>
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Average
Rating 4.25 0.73 4.50 0.61 4.24 0.90

Table 24

**Champion Highest Rated Project Success Question**

<table>
<thead>
<tr>
<th>Question</th>
<th>Champion Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management supported decisions and changes</td>
<td>5.00</td>
</tr>
<tr>
<td>Organizational politics experienced during the project were successfully negotiated.</td>
<td>5.00</td>
</tr>
<tr>
<td>The customers’ definition of quality was considered and defined by the key critical-to-quality project measures.</td>
<td>5.00</td>
</tr>
<tr>
<td>Project followed a scheduled plan</td>
<td>4.80</td>
</tr>
<tr>
<td>Impacted departments and personnel were please with the project outcome.</td>
<td>4.80</td>
</tr>
<tr>
<td>Technical tasks were accomplished</td>
<td>4.80</td>
</tr>
</tbody>
</table>
Table 25

*Project Leader Highest Ranking Project Success Question*

<table>
<thead>
<tr>
<th>Question</th>
<th>Project Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. The critical success factors were achieved.</td>
<td>5.00</td>
</tr>
<tr>
<td>15. Management supported decisions and changes</td>
<td>5.00</td>
</tr>
<tr>
<td>18. Project management training was helpful to the project leader.</td>
<td>5.00</td>
</tr>
<tr>
<td>21. Periodic monitoring of the project success, timely feedback, and</td>
<td>5.00</td>
</tr>
<tr>
<td>communication were helpful toward project success.</td>
<td></td>
</tr>
<tr>
<td>29. The customers’ definition of quality was considered and defined by</td>
<td>5.00</td>
</tr>
<tr>
<td>the key critical-to-quality project measures.</td>
<td></td>
</tr>
<tr>
<td>16. Project followed a scheduled plan.</td>
<td>4.80</td>
</tr>
</tbody>
</table>

Table 26

*Team Member Highest Ranking Project Success Question*

<table>
<thead>
<tr>
<th>Question</th>
<th>Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>29. The customers’ definition of quality was considered and defined by</td>
<td>4.72</td>
</tr>
<tr>
<td>the key critical-to-quality project measures.</td>
<td></td>
</tr>
<tr>
<td>16. Project followed a scheduled plan.</td>
<td>4.72</td>
</tr>
<tr>
<td>14. The critical success factors were achieved.</td>
<td>4.58</td>
</tr>
<tr>
<td>15. Management supported decisions and changes</td>
<td>4.53</td>
</tr>
<tr>
<td>33. Organizational infrastructure including training, tools, and</td>
<td>4.47</td>
</tr>
<tr>
<td>mentor-type human relationships were available and used to achieve</td>
<td></td>
</tr>
<tr>
<td>project success.</td>
<td></td>
</tr>
<tr>
<td>23. Organizational politics experienced during the project were</td>
<td>4.47</td>
</tr>
<tr>
<td>successfully negotiated.</td>
<td></td>
</tr>
</tbody>
</table>
Table 27

**Champion Highest Ranking Mentoring Effectiveness Question**

<table>
<thead>
<tr>
<th>Question</th>
<th>Champion Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>42. The mentor (Champion, Master Black Belt, or Project Leader) showed an interest in the employees that participated on project teams.</td>
<td>4.80</td>
</tr>
<tr>
<td>44. The mentor (Champion, Master Black Belt, or Project Leader) was successful in enabling the learning experiences.</td>
<td>4.80</td>
</tr>
<tr>
<td>45. The Champion and Master Black Belt were effective in providing an educational environment conducive to learning.</td>
<td>4.80</td>
</tr>
<tr>
<td>46. The Champion, Master Black Belt, or Project Leader provided guidance in the development of the project leader in project management.</td>
<td>4.80</td>
</tr>
<tr>
<td>57. The Six Sigma program was effective in encouraging employees to cooperate in joint team efforts in the organization.</td>
<td>4.80</td>
</tr>
<tr>
<td>58. The Champion, Master Black Belt, or Project Leader was effective in contributing to project success.</td>
<td>4.80</td>
</tr>
<tr>
<td>63. The Champion, Master Black Belt, or Project Leader was effective in preparing individuals for his or her role on a process improvement team.</td>
<td>4.80</td>
</tr>
<tr>
<td>43. The Champion and Master Black Belt were effective in matching skills when selecting the project teams.</td>
<td>4.60</td>
</tr>
</tbody>
</table>
Table 28

*Project Leader Highest Ranking Mentoring Effectiveness Question*

<table>
<thead>
<tr>
<th>Question</th>
<th>Project Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>42. The mentor (Champion, Master Black Belt, or Project Leader) showed an interest in the employees that participated on project teams.</td>
<td>5.00</td>
</tr>
<tr>
<td>44. The mentor (Champion, Master Black Belt, or Project Leader) was successful in enabling the learning experiences.</td>
<td>5.00</td>
</tr>
<tr>
<td>45. The Champion and Master Black Belt were effective in providing an educational environment conducive to learning.</td>
<td>5.00</td>
</tr>
<tr>
<td>46. The Champion, Master Black Belt, or Project Leader provided guidance in the development of the project leader in project management.</td>
<td>5.00</td>
</tr>
<tr>
<td>47. Champion, Master Black Belt, or Project Leader was effective in providing a nurturing process that aids in the development of the protégé.</td>
<td>5.00</td>
</tr>
<tr>
<td>58. The Champion, Master Black Belt, or Project Leader was effective in contributing to project success.</td>
<td>5.00</td>
</tr>
<tr>
<td>63. The Champion, Master Black Belt, or Project Leader was effective in preparing individuals for his or her role on a process improvement team.</td>
<td>5.00</td>
</tr>
<tr>
<td>64. The Six Sigma program levels of expertise (Champion, Master Black Belt, and Project Leader) act as a support structure for the project teams.</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Table 29

*Team Member Highest Ranking Mentoring Effectiveness Question*

<table>
<thead>
<tr>
<th>Question</th>
<th>Team Members</th>
</tr>
</thead>
</table>
42. The mentor (Champion, Master Black Belt, or Project Leader) showed an interest in the employees that participated on project teams.

50. Champion, Master Black Belt, or Project Leader were effective in providing confirmation and acceptance within the organizational culture.

58. The Champion, Master Black Belt, or Project Leader was effective in contributing to project success.

43. The Champion and Master Black Belt were effective in matching skills when selecting the project teams.

48. The Six Sigma program was effective in benefiting the mentor, team leaders, and the organization.

51. The protégé benefited from the Champion, Master Black Belt, or Project Leader's knowledge, experience, and status.

64. The Six Sigma program levels of expertise (Champion, Master Black Belt, and Project Leader) act as a support structure for the project teams.

38. Mentoring was effective in helping me to understand the DMAIC process.