

2008

# The effect of problem/project-based learning on a desired skill set

Todd L. Sirotiak  
*Iowa State University*

Follow this and additional works at: <http://lib.dr.iastate.edu/etd>



Part of the [Civil and Environmental Engineering Commons](#)

---

## Recommended Citation

Sirotiak, Todd L., "The effect of problem/project-based learning on a desired skill set" (2008). *Graduate Theses and Dissertations*. Paper 11139.

This Dissertation is brought to you for free and open access by the Graduate College at Digital Repository @ Iowa State University. It has been accepted for inclusion in Graduate Theses and Dissertations by an authorized administrator of Digital Repository @ Iowa State University. For more information, please contact [digirep@iastate.edu](mailto:digirep@iastate.edu).

**The effect of problem/project-based learning on a desired skill set  
for construction professionals**

by

**Todd L. Sirotiak**

A dissertation submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Civil Engineering (Construction Management)

Program of Study Committee:  
Loren Zachary, Co-major Professor  
Russell Walters, Co-major Professor  
Larry Ebbers  
Charles Jahren  
Edward Jaselskis  
Mack Shelley II

Iowa State University

Ames, Iowa

2008

**DEDICATION**

To the students  
at Iowa State University  
who take construction engineering classes,  
especially those who participated in this research.

The joy a teacher experiences is when a student  
makes a connection between knowledge and life.

Teachers are stewards who are entrusted to  
empower each next generation to become  
successful leaders.

## TABLE OF CONTENTS

LIST OF TABLES .....	vi
LIST OF FIGURES .....	vii
ABSTRACT .....	viii
CHAPTER 1. INTRODUCTION .....	1
Necessity of People Skills for Successful Construction Professionals .....	1
Related Research .....	2
Pedagogy of Teaching Soft Skills .....	4
Dissertation Organization .....	5
CHAPTER 2. LITERATURE REVIEW .....	7
Importance of Soft Skills in the Construction Industry .....	7
Professional Consultant Studies on Soft Skills .....	8
Academic Research on Soft Skills .....	9
Industry Investigation .....	11
ABET Direction .....	13
Need for an Alternative Learning Method .....	15
Assessment Tool Selection .....	16
MBTI .....	17
Bar-On EQi (133) .....	17
CVF .....	18
Emotional Intelligence Theory .....	18
Bar-On's Theory of Emotional Intelligence .....	20
Competing Value Framework Theory .....	22
Quinn's Theory of Competing Value Framework .....	25
CHAPTER 3. HYPOTHESES .....	28
Research Questions .....	28
Hypotheses .....	29
CHAPTER 4. METHODOLOGY .....	33
Definition of Terms .....	35
Institutional Review Board Approval .....	37
Participants and Sample .....	37
Class Activities .....	41
Conceptual project .....	42
Residential project .....	42
Qualification and marketing package .....	42
Commercial project .....	43
Design project .....	43

Bar-On Assessment Tool .....	45
CVF Assessment Tool CVSS .....	48
Data Collection .....	53
Limitations .....	54
Summary .....	56
<b>CHAPTER 5. DATA ANALYSIS .....</b>	<b>57</b>
Quantitative Statistical Significance .....	57
Overview .....	58
Normality .....	58
Correlation .....	59
Cronbach alpha results .....	62
Hypothesis testing .....	63
Hypothesis 1: Confidence and the ability to cope under stress	
Confidence and Stress Coping .....	64
Hypothesis 2: Leadership abilities and communication skills .....	65
Leadership .....	65
Communication .....	65
Hypothesis 3: Adaptability and management skills Adaptability .....	67
Adaptability .....	67
Management .....	68
Summary .....	69
Qualitative Findings .....	71
Overview .....	71
Trustworthiness .....	72
Review of validity .....	73
Validity and realism .....	75
Research investigation .....	77
Research 1: Confidence and stress coping skills – Confidence .....	77
Stress tolerance .....	80
Research 2: Leadership and Communication Skills – Leadership .....	84
Communication .....	87
Research 3: Adaptability and Management Skills – Adaptability .....	95
Management .....	98
PBL effect .....	102
Summary .....	104
<b>CHAPTER 6. DISCUSSION .....</b>	<b>106</b>
Summary of the Study .....	106
Analysis and Discussion Overview .....	108
Confidence and stress coping .....	109
Leadership and communication .....	111
Ability and management .....	114
PBL effect .....	116
Implications for Practice .....	117

Future Study .....	117
Challenges .....	118
CHAPTER 7. RECOMMENDATIONS AND CONCLUSION .....	122
APPENDIX A. HUMAN SUBJECTS APPROVAL .....	124
APPENDIX B. COURSE SYLLABUS.....	125
APPENDIX C. STATISTICAL DATA.....	128
APPENDIX D. NORMALITY PLOTS .....	170
REFERENCES .....	176
ACKNOWLEDGMENTS .....	184

## LIST OF TABLES

Table 2.1.	Summary of Odusami’s skills sets.....	13
Table 4.1.	Bar-On EQi scales, subscales, and definitions (adapted from Bar-On, 2005)....	46
Table 4.2.	Interpretive guidelines for EQi scores .....	47
Table 4.3.	Summary of managerial leadership and competencies.....	50
Table 5.1.	Correlation results summarized according to hypothesis .....	60
Table 5.2.	Cronbach alpha results summarized according to hypothesis .....	63
Table 5.3.	Summary of Assertiveness (Confidence) and Stress Tolerance (Coping).....	64
Table 5.4.	Leadership abilities and communication skills based on Leadership (CVSS) ...	66
Table 5.5.	Leadership abilities and communication skills based on Communication (CVSS).....	66
Table 5.6.	Adaptability and management skills based on Adaptability (CVSS) .....	68
Table 5.7.	Adaptability and management skills based on Management (CVSS) .....	69

**LIST OF FIGURES**

Figure 2.1. Competing values framework.....26

Figure 4.1. Concurrent triangulation.....34



**ABSTRACT**

The purpose of this study was to investigate if a Problem/Project-Based Learning (PBL) approach can affect certain non-technical, “soft” skills of construction engineers. Such skills include leadership, adaptability, and stress management. In mixed design research, quantitative and qualitative data are assembled and analyzed collectively. For this study, two separate assessment tools were used for the quantitative portion, while open-ended written reflections and a partially closed-ended senior questionnaire were implemented for the qualitative portion.

A hypothetical model was used to investigate certain soft skills based on prior research documenting need. Skills investigated were confidence, stress coping, leadership, communication skills, adaptability, and management skills. Descriptive statistics, open-ended final written reflections, and a partially closed-ended senior questionnaire were used to analyze the data.

PBL is a process in which the students are challenged to develop realistic solutions on open, less structured, real world type problems. The results of this study performed with the combined count of nearly 60 students suggest that PBL can influence several soft skills of senior construction engineers. Specifically, these findings demonstrate the following: (a) PBL appears to affect students’ soft skills; (b) students appear to recognize the realism and “real world” applicability that PBL brings to their skill development; and (c) the data suggest that the experience is holistic and offers opportunities for balanced growth in several ways. Some key competencies such as communication and leadership indicated significant enhancements. Although this study was limited to one academic year of the university’s

construction engineering program, it provides interesting insight to changes within the time period investigated.

This study should be replicated in other construction engineering environments to investigate a larger population sample. In addition, industry, professional consultants, and academic entities are encouraged to review current learning methods to ensure that they are implementing the findings and methodology offered in this study.

## CHAPTER 1. INTRODUCTION

### **Necessity of People Skills for Successful Construction Professionals**

The current trend in the construction industry is to build better, faster, and more cost-effectively. Accomplishing this requires the job to be fast-tracked through a team-based approach, such as design-build. This trend requires managers to solve tasks with the assistance of team members, and limitations on time and resources. Due to these challenges, it is critical that organizations employ staff who can work effectively with various types of individuals (Kichuk & Wiesner, 1997). An organization should examine beyond cognitive abilities and look for attributes to enhance team performance. These demands exacerbate the need for construction project managers to have “soft skills” (e.g., communication and stress coping) in addition to “hard skills” (e.g., means and methods of construction).

One of the challenges that organizations face today is the need for qualified employees with positive personality traits. Personality must be carefully considered when accomplishing numerous assignments in various work groups and team performance. Kumar and Hsiao (2007) noted “soft skills” are nontechnical skills such as communication, management, and leadership which are required to successfully practice engineering.

Despite the known challenges of communications in the construction industry, Thamhain (1992, as cited in Thomas et al., 1998) expressed that few accomplishments have been made. Thamhain’s research identified 30 potential problems that inhibit a successful project. These items can be classified into the following five groups:

- Problems with organizing a project team
- Weak project leadership

- Communication problems
- Conflict and confusion
- Insufficient upper-management involvement.

This list indicates that interpersonal skills are a critical part of a manager's success. Highly valued managers possess these critical soft skills and use them to make appropriate decisions under real-world conditions. Having a means to assess aptitude in these areas would be a great asset, as it would facilitate better training for current and future project managers. Such an assessment tool would also enable validation of pedagogical methods used to prepare future construction professionals.

In order to investigate aptitude in a quantitative format, this study used both the EQi and the CVSS. The EQi is an assessment tool which identifies non-cognitive items associated with success, while the CVSS is a tool which has been recognized as providing business related competencies. The EQi and the CVSS were used in conjunction with the qualitative information in order to provide triangulation to the mixed design methodology implemented in this study.

### **Related Research**

Previous studies have analyzed the Bar-On Emotional Quotient Inventory (EQi 133), a multifactor model which assesses the potential for performance, as a tool to assess soft skills. Jaeger (2003) focused on teaching Bar-On categories and assessing based on the condition that pre and post results indicate change. Another study of the Bar-On by Songer et al. (2004) focused on the soft tools generally that are needed in a successful construction project. Songer's study identified lower than average interpersonal skills for the General

Contracting sector, and the need for methods to improve the communication issues experienced in construction. However, changes to engineering education that might address these issues were not proposed.

A study by Johnson and Singh (1998) utilized the Meyers-Briggs Type Indicator (MBTI), a grouped personality type indicator, to identify personality types of construction and design engineers at a state-run agency. Another study by Carr et al. (2002) investigated how one's personality may be predictive of their job performance through the use of the MBTI. An investigation by Singh (2002) provided insight into hemisphericity (left side vs. right side brain) orientation of construction and design engineers at a large public construction organization for further investigation into behavioral perceptions. Bernold (2004) used the Learning and Study Strategies Inventory (LASSI) to help identify that the *method* of delivery of teaching material is critical to the person being educated and to subsequently argue that lecture based teaching may be causing some students to leave the program. A study by Zolin et al (2003) looked specifically at the category of trust as it relates to an interpersonal level in a problem-based learning (PBL) environment. In the Zolin study, it was posited that PBL increased trust.

Although numerous articles have listed the benefits of problem-based learning, Prince (2004) noted that few data are available which document the effectiveness of this method with undergraduate engineers. Gushgari et al (1997) suggested that further research specifically focusing on the makeup of critical skills would provide insight and advantages to professional development of engineers. Although several have argued that providing professional competencies in graduates would be a monumental challenge, Coll and Zegwaard (2006) concluded these competencies are important.

### **Pedagogy of Teaching Soft Skills**

The current study focused on the use of an active learning hybrid (Problem/Project-Based-PBL) learning method (Prince & Felder, 2006). Prince (2004) conjectured it is not possible to find a universal definition of active learning. According to Bonwell and Eison (1991), active learning is engaging students in problem solving, discussion, reading, and writing to develop higher level thinking skills such as assessment investigation and synthesis. Since active learning has been identified as one of the most positive developments in higher education (McKeachie, 2002), this study investigated whether PBL impacts the outcome of six specific “soft skills”: confidence, coping with stress, leadership, communication, adaptability, and management.

Prince and Felder (2006) reviewed the main criteria in problem-based learning. They stressed that problem-based learning begins with providing students open-ended, weakly structured, real world problems. The instructor acts as a facilitator while the students perform a multitude of tasks to complete a final product and/or design.

Project-Based Learning generally focuses on developing a finalized product that requires one to use knowledge acquired from previous classes. During this process, students perform significant amounts of investigation and self-directed learning within small groups (Yeo, 2005). During this process the teacher acts as a professional guide, facilitator, or advisor (Camargo & Mizukami, 2005). The traditional lecture-style learning should be avoided as it is detrimental to the learning styles and thinking skills that are highly valued in the engineering profession (Bernold et al., 2007; Brown, 2004).

Based on this concept, the senior capstone construction engineering class can be described as a small group experience in which students employ active learning using a

combination of Problem/Project-Based Learning. Students worked in small groups to solve a multitude of problems and projects in a real-world type environment. They were guided to employ self investigation, acquire resources, and provide solutions in a multi-tasking environment. This style of learning involved a variety of processes requiring a facet of skills including communications (written and oral), decision making, problem solving, time management, planning, and organizing. Traditional lecture-based delivery was rarely used only to help clarify expectations and boundaries.

The capstone class (Con E 461) in the Construction Engineering major was crafted using a hybrid of problem- and project-based theories. Teams of students were given ill-defined, open-ended, real-world type problems with strictly enforced deadlines. The students selected their own teams, and were provided tasks beyond the capability of any individual team member. This heavy task load enabled the students to develop soft skills necessary to function as a team or risk failure to complete the project. The soft skills are critical to succeed in the construction profession, wherein engineers and others must work together successfully to produce final designs and concepts. Chapter 4 provides additional information on the PBL activities.

### **Dissertation Organization**

This study was designed to contribute to the studies and research on the effect of PBL on the soft skills of construction engineers. The use of PBL in a learning environment will further help determine if certain soft skills are affected. This first chapter provided the introduction to the necessity of soft skills, a brief introduction to the related research, and the general idea of PBL. Chapter 2 provides an overview of prior research, studies, and surveys

which indicate the importance of soft skills in the construction industry. Based on prior investigation in the construction industry, professional consultants, and academic research, there is a need to teach soft skills to students.

Chapter 3 details the research questions and hypotheses pursued in this study. The development, explanation, and clarification of each item are provided. Chapter 4 outlines the methodological approach, participants and sample, assessment tools used, data collection, and the limitations of the study.

Chapter 5 describes the data analyses for this study. A further explanation of the data, investigation of normality, correlation, and Cronbach alpha are provided. Results from the pre-test and post-test are presented and summarized. This chapter also provides the qualitative analysis and findings for two separate semesters of the PBL class, Con E 461. The students' perspectives are expressed and explored, and a summary of themes and patterns is provided.

Chapter 6 summarizes the research and provides discussion of the results. Finally, Chapter 7 provides the conclusion and recommendations for practice and future research.



## CHAPTER 2. LITERATURE REVIEW

*The most important single ingredient in the formula of success is the knack of getting along with people.* Theodore Roosevelt

### **Importance of Soft Skills in the Construction Industry**

Klinger (1956) identified the need for changes in academia and proposed a new Construction Engineering curriculum for contractors. He noted that the majority (88%) of the contractors surveyed were dissatisfied with the education of engineers entering their profession. Klinger recognized the need for the development of special curriculum to teach soft skills. His proposal recommended including psychology, humanities, English, and public speaking. Klinger also proposed that these types of business-related skill sets could be of more use to the construction engineer than highly technical skills, or cognitive skills that would be more applicable for the purpose of design.

Educational leaders have also questioned schools' focus on cognitive skill sets, when other valuable skills can be learned in a non-traditional method (Resnick, 1987). Along this line of thought, an investigation of Bell Labs indicated that IQ and academic talent were not good indicators of productivity, or of star performer success (Kelley & Caplan, 1993). According to Kemper (1999), emotional intelligence may be more important than technical and cognitive abilities combined.

Goleman (1998) noted the need in business for soft skills. In a study of over 2,000 highly effective administrators, Goleman concluded that all but 2 of 16 skill sets involved emotional competencies. Subsequently, Goleman (1999) specifically referenced construction firms and recommended that they invest time and effort in developing emotional intelligence.

Goleman noted that top performers had professional skill competencies of serving clients though flexibility, teamwork, persuasion, influence, and self-confidence. He further identified current building engineers as needing stronger emotional skills. He stated that education and construction companies can no longer ignore this problem.

Nyman (2005) identified the need for leadership intelligence as it pertains to staff development and engineers. Nyman provided additional comments supporting the need for soft skills, identified how current engineering programs provide little training in these critical areas, and demonstrated the need for engineers to obtain skills that are critical to their long-term growth.

### **Professional Consultant Studies on Soft Skills**

Fails Management Institute (FMI), recognized in the field of construction consulting, has provided surveys for more than 15 years to national construction firms to identify potential challenges and trends in the construction industry. As part of this process, FMI compiled numerous documents that indicate a constant need for improvement. In 2000, FMI documented that the industry of construction professions has evolved to a “business-centered practice” rather than a “practice-centered business” (Hessen, 2000, p. 1). Through their research in the FMI Project Manager Academy, FMI further determined several facts regarding strengths and weaknesses of project managers.

Studies by FMI indicated that very successful project managers had superior scores in soft skills. These non-technical professional skills are basic interpersonal skills that were described as critically lacking in the construction industry. Notably, these skills can be lacking to the extent that, when a new leadership position becomes available, several of the

candidates lack the necessary leadership and interpersonal skills to lead (Adamchick & Perriccio, 2004). In the Summer/Fall of 2005, FMI followed up with a Project Management Survey (FMI 2006) given to 196 general contractors. This survey determined the various criteria for Project Managers (PMs).

In the skills section of the study, experience and communication skills were identified as the most important requirement for PMs. FMI's overall survey demonstrated that larger organizations (> \$201 million) placed the highest priority on communication skills, rather than experience or financial management skills. During a PM's career, the true leaders improve their management and leadership skills through advancement of their soft skills (Schoppman, 2006).

In 2007, FMI developed a new report, "Talent Development," and collected data from over 50 diverse contractors. In this survey, the respondents identified the core competencies that are predictive for organizational success. While further investigation provided training challenges in various competencies for field managers, project managers, and senior managers, communication skills was the most recognized challenge for all positions (Wilson, 2007).

### **Academic Research on Soft Skills**

The issue of soft skill deficiency has become so alarming and significant that academia and other directly related professionals have attempted to provide direction and implementation. Articles on the future of engineering have provided examples of the need to address such issues. The need for realistic examples, closer industry-university relations, and for curricula to impart communication and team skills were identified as critical (Roessett &

Yao, 2002). Due to increasing complexity and diversity, society has begun to call for a broader range of skills for engineers (Sinha et al., 2002).

According to Weingardt (2001, as cited in Russell, 2003), the American Society of Civil Engineers (ASCE) 2001 Task Committee stated that the formal education Civil Engineers lacks sufficient skills in non-technical knowledge and skills. Thus, non-engineers are often directing engineers due to their stronger leadership, business, and communication skills. Chinowsky (2002) argued that university programs could further broaden engineering education through the introduction to management related courses. While some reinforced the need for business and management skills, Farr and Merino (2002) identified the challenges of incorporating these needs into academia. Gilleard and Gilleard (2002) also provided a perspective on how soft skills will be critical as communication and culture interact with new multinational corporations.

These types of issues have also aroused the attention of several of the governing bodies of academia. ASCE stated its direction through the Body of Knowledge (BOK) and Policy Statement 465, which attempts to assist in people skills, management, leadership, and—most importantly—communication (Russell et al., 2004). The BOK helps many realize that there is more to professional capabilities than cognitive skills. Brown (2004) stated that problem-based learning is a method to help make the transition. In addition to ASCE BOK, and Policy 465, ABET 2000 also focused on soft skills and defined new initiatives that predict the most important impact to engineering in 15 years (Shuman et al., 2005). Shuman and others pointed out that ABET's Criterion 3 (outcomes) provides 11 outcomes of which 5 are hard skills while the remaining 6 are soft skills. Shuman's group posited that a new education must be built around an active, problem-type learning environment.

### **Industry Investigation**

Industry has also shown concern regarding the development of soft skills. Studies by Thomas et al. (1998) and Bernold (2007) revealed the industry's dissatisfaction with the quality of graduates' soft skills prior to the 1980s. Thomas noted several Construction Industry Institute (CII) publications (1986, 1987, 1992, and 1995) that indicated a growing concern regarding soft-skill development. Davies et al. (1999) identified this need for soft skills and conjectured that practitioners typically complain that graduates lack practical knowledge and need good interpersonal, communication, creativity, problem solving, and flexibility skills. Coll and Zegwaard (2006) noted that science and technology employers are more interested in adaptability, desire to learn, teamwork, cooperation, motivational drive, and analytical thinking. While business employers expressed a similar focus (e.g., adaptability and desire to learn) they also focused on the desire for customer service, achievement, and computer abilities.

The concern for soft skill development was driven by a comparison of hiring, promotion, and firing practices. Russell and Yao (1996) studied the hiring practices of employers of engineers and found that, although engineers were often hired for their technical ability, they were generally promoted for their leadership and managerial skills, and dismissed for poor people skills. Guishgari et al. (1997) found that soft skills of employees, such as effective communication, are a critical part of any company's success, regardless of whether the employee is a senior executive or a project manager. Cano et al. (2006) analyzed the required skills for project management and found that the items likely lost in lectures are the very soft skills required for success in management. When corporations look for newly-

hired MBAs, the firms focus on communication, interpersonal, and initiative skills (Caudron, 1999).

Some educators contend that students must be active in their learning environment if deficiencies in soft skills are to be minimized. Wellington et al. (2002) found that education is failing in communication, problem solving, leadership, diversity, flexibility, and ability to cope with ill-defined problems. This explains the disparity between the needs of employers and the skills of new graduates. Wellington referred to an American Council of Education report which revealed that 9 out of 10 graduates believed their degree did not help in workplace performance. The authors further posited that real world problems are not well structured and require additional skills beyond traditional, well-structured education to solve problems. Bernold (2007) further argued that ABET's changes encourage replacing lecture-based teaching in favor of alternate active methods of learning.

Although numerous articles have been published based on surveys regarding the skill sets required to produce successful engineers, perhaps one of the more extensive reviews of needs within the industry was developed by Odusami (2002). Odusami presented a summary of 9 papers that investigated skill sets required of engineers which revealed that soft skills were consistently leading indicators in prior research. One of the objectives of Odusami's research was to review prior documentation and to determine the most important skill sets. Odusami's study reviewed effective leaders based on perceptions of clients, consultants, and contractors, soft skills dominated the categories. Odusami's summary ranking soft skill sets is shown in Table 2.1.

Table 2.1. Summary of Odusami's skills sets (numbers indicate ranking)

Skill	Clients	Consultants	Contractors	Average
Decision making	1	2	2	1
Communication	2	3	1	2
Leadership/Motivation	5	1	4	3
Problem Solving	7	5	5	4
Time Management	4	8	8	5
Organizing	6	7	7	6
Planning and goal setting	3	4	3	7
Technical knowledge	9	9	6	8
Financial planning	11	6	10	9
Quality management	10	10	9	10
Listening	6	11	11	11
Delegating	12	13	12	12
Negotiating	13	12	13	13

Note: The table represents as summary of both hard and soft skills identified by Odusami.

As shown in Table 2.1, the number one item for contractors is communication, followed by decision-making, planning and goal setting, and leadership/motivation. Technical knowledge ranks number six.

### **ABET Direction**

It should be evident that industry, consultants, an even prior academic research have indicated a need for soft skills in engineering. However, perhaps the most compelling reason for engineering programs to change comes from the Accreditation Board for Engineering and Technology, Inc. (ABET). ABET is an accreditation group that is partly responsible for supporting innovative approaches to engineering programs. As part of the accreditation process, ABET has recognized and made recent major changes in their engineering education

format (Shuman et al, 2005). Some of these changes can be visualized in review of the new eleven ABET criterion 3 outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. (Accessed 8/9/2007, from <http://www.ele.uri.edu/faculty/daly/criteria.2000.html>)

From a review of the literature and the direction for ABET since 2000, the need for soft skills became apparent regarding several of the aforementioned listed outcomes. For example, the ability to function in multi-disciplinary teams (d), professional and ethical responsibility (f), communication (g), engineering solutions in a global and societal context (h), engagement in life long learning (i), and contemporary issues (j) are related to the soft or non-cognitive skills that an engineering professional must successfully acquire. Therefore, to prepare construction engineers for the world of work, academia must support new educational techniques that foster the development of soft skills of future engineers. The current study investigated PBL as a method for developing soft skill sets required of construction engineers.



### **Need for an Alternative Learning Method**

Roselli and Brophy (2006) indicated some of the current challenges facing teachers in an article in which they identified the challenges associated with normal lecture-based learning. They revealed that, although 85-90% of Civil Engineering students prefer lecture-based delivery, other studies indicated that most students only learn 70% of the first 10 minutes of the lecture material presented in class. Roselli and Brophy further questioned whether a focus on mathematical problem solving is constructive for an industry that requires creative engineers with strong communication and problem-solving abilities.

According to Bernold (2004), a polled engineering faculty report stated that 87% use lecture as their sole method of instruction, and indicated that only 50% of engineering students were satisfied with the program. Contrary to the lecture-based delivery model, an active style learning method such as problem-based or project-based learning has been suggested as a solution. In a review of current teaching practices of communication faculty, Camargo and Garca (2005) revealed that new graduates can no longer rely solely on sound technical and knowledge-based skills. They posited that problem-based learning methods may be of greater value to future employers.

Russell and Yao (1996) further indicated that, while there may be numerous challenges in making changes, project-based learning seems to be a critical aspect of success. In other words, engineers learn their trade best when they practice the skills they will need to perform successfully on the job. In a subsequent article, Bernold et al. (2007) conjectured that in order to attempt to satisfy the current needs of construction engineering, changes in instruction techniques would be required. Avoiding typical rote-style teaching enables

students to advance in subfields of engineering driven by active learning, problem-solving, and interaction required in solving difficult problems.

Since numerous articles have provided evidence of the benefits of nontraditional learning styles, engineering educators should consider various methods to improve achievement and student attitudes (Prince, 2004). Although many believe that successfully teaching soft skills such as creativity or innovation can be controversial (McGraw, 2004, Prince, 2004), others believe that soft or professional skills can be taught successfully (Shuman, 2005). Still others have referenced recent findings that indicate success in providing an actual shift in the Herrman Brain Dominance Instrument (HBDI) toward creative thinking, and away from the prior “plug and chug” mentality (Bernold, 2007).

Soft skills are necessary for success in today’s construction environment. Although it has been argued that PBL is the most difficult method to execute successfully (Prince & Felder, 2006), it may be the very bridge to success that the industry seeks. In order to assess the validity of this idea, the current study used two forms of industry standard assessment instruments: an emotional intelligence inventory (EQi), and the competing value framework (CVSS). It was anticipated that findings of this research will contribute evidence to support this statement.

### **Assessment Tool Selection**

Although there are numerous testing instruments available to measure the skill levels of managers—Meyer Briggs Type Indicator (MBTI), California Personality Inventory (CPI), Fundamental Interpersonal Relations Orientation-Behavior Scale (FIRO-B, etc.—this researcher decided to use the Bar-On (EQi 133), and a product of the Competing Values

Framework (CVF) model the Competing Value Skill Surveys (CVSS). The purpose for the selection of these tools was to investigate whether soft skills sets would result in a change of behavior of the students who volunteered to participate in the research.

### **MBTI**

Although the Meyers-Briggs Type Indicator (MBTI) is readily available and provided a possibility for utilization, certain factors eliminated its selection for this research.

According to the MBTI manual (Myers et al., 2003, p. 3), the assessment tool is based on Jung's theories of personality types with the additional section of judging and perceiving. Subsequent development of MBTI separated the assessment tool into four separate groups. This development was performed in order to gain a more thorough understanding of how a person may be influenced by his or her innate characteristics. However, according to the theory, a person is guided by their preferences and would be very resistant to change (Helmreich, 1984). Since the intent of the study was to investigate potential change, the MBTI tool was determined to be less applicable for this research.

### **Bar-On EQi (133)**

As briefly described in Chapter 1, the Bar-On assessment tool investigates the potential for performance. Since this tool is able to investigate potential changes in confidence and stress tolerance, a key to success (Stein & Book, 2000), it was pursued. Further investigation indicated that the EQi also has extensive prior use throughout the world in educational and business management research (Bar-On, 2005). This tool is known for quantitatively scoring various non-cognitive realms that are associated with a person's ability for success (Stein & Book). The Bar-On is also based on significant research, and has an

extensive database and online capabilities. In addition, the current researcher was educated in its usage by a trainer associated with Multi-Health Systems, Inc. (MHS) at a Minneapolis training session.

### **CVF**

The Competing Value Framework (CVF) model has been recognized as a leading concept in many Master of Business Administration (MBA) programs throughout the world (Quinn, 2004). The CVF model has had prior world wide usage, and this researcher had utilized the CVF's assessment tool Competing Value Skill Surveys (CVSS) in prior graduate work, it was investigated for use in the current study. Since the business assessment tool provided quantitative data on business related competencies, and the model is associated with Klinger's (1956) recommendation to include business practices in construction engineering education, it was selected as an applicable tool for this study.

The CVSS and Bar-On instruments were also selected because of their extensive use in organizations, reliability, and validity. A history of their success is further described in Chapter 4.

### **Emotional Intelligence Theory**

The history and study of emotional intelligence and its attributes has generally been a topic of great discussion and conflict. This conflict was acknowledged by Sternberg (1985), who explained that the study and defining of intelligence is a very challenging subject. A psychologist at Harvard University and pioneer in the field, Gardiner (1983) further refined areas based on his prior work and, he also helped refute the Intelligence Quotient (IQ) view

of intelligence. Although Gardner further developed inter- and intrapersonal summaries, he did not substantively review the role of feeling within intelligence (Goleman, 1995).

Salovey and Mayer (1990) developed the term “emotional intelligence” (p. 15) that clarified the ability to realize, monitor, and use such information to guide decisions and actions. Others such as Daniel Goleman (1995) and Reuvan Bar-On (2005) further pursued the topic of emotional intelligence, and developed additional frameworks and thoughts regarding this subject. For example, Goleman (1995) cited studies that have further indicated that people with damaged prefrontal-amygdala, but exhibiting no apparent IQ or cognitive disability, have made catastrophic decisions due to their lack of emotional learning (e.g., Amasico-Descartes Error: Emotion, Reason and the Human Brain (Putnam, 1994)).

Since it is a challenging topic, not all researchers blindly support emotional intelligence as a specialized topic within peoples’ various interaction problems. This thought was elicited by Spector (2005), who commented that few topics have been as controversial in the area of organizational research and psychology as emotional intelligence. In 2005, Louke (2005) stated that some people are arbitrarily assigning the word “intelligence” to various habits and skills, with the definition therefore becoming so broad that the concept of intelligence has become unintelligible. However, prior researchers (Mayer, Caruso, & Salvoey, 2000) have asserted that emotional intelligence is scientifically legitimate, and that emotional intelligence does meet classic criteria for standard intelligence.

There are several assessment tools available that claim to measure emotional intelligence. Since these tools are often based on proprietary data, scientific analysis of the tools’ validity is difficult (Landy, 2005). Conte (2005) looked at four of the major emotional intelligence assessments available:

- Emotional Competence Inventory (ECI);
- Emotional Quotient Inventory (EQi);
- Multifactor Emotional Intelligence Scale (MEIS); and
- Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEI).

Conte (2005) cited a concern that although emotional intelligence has shown adequate internal reliability, validity has lagged behind reliability evidence. Conte does concede, however, that this may be due to researchers who are unwilling to be specific about what they measure and score with proprietary information. Landy (2005) had also noted this concern.

In response to the prior articles by Landy (2005), Locke (2005), and Conte (2005), a few researchers specifically countered their concerns and defended the value, use, and pursuit of emotional intelligence (Ashkanasy & Daus 2005). Although Ashkanasy and Daus expressed concern over endorsing products for workplace studies, they did not disparage studying the products in applied settings. Ashkanasy and Daus acknowledged that, although proprietary information was not the best, it was hardly a fatal flaw. They further concluded in the article that emotional intelligence has been neglected for too long and will be part of organizational research for the future.

### **Bar-On's Theory of Emotional Intelligence**

Bar-On's theory of emotional intelligence was the first such product available for practitioners, and has been used in teambuilding, leadership development, coaching, performance management, self development, career planning, and the re-shaping of culture, in addition to other organizational development. The current study used the Bar-On as one of

its assessment tools in order to model emotional intelligence for viewing soft skills. Since Bar-On's main concept was to develop a tool that would define and quantitatively describe portions of emotional intelligence (Bar-On, 2004), this assessment tool was used in the current research to differentiate emotional from cognitive intelligence.

Bar-On's assessment has 5 major components and 15 conceptual subscales (see Table 4.1). According to the Bar-On technical manual, the summary of the major scales can be visualized in the following manner:

1. The ***intrapersonal composite*** scale determines the ability to understand oneself, and to identify feelings and emotions. This skill also allows a person to positively express feelings while being self-directed, and to release his or her full potential.
2. ***Interpersonal composite*** scales determine the ability to read and comprehend the feelings of others. This achievement of emotional recognition helps one contribute as a positive social member, and establish satisfying relationships.
3. The ***stress management*** scale measures the ability to handle events and stressful situations while resisting impulsive behavior.
4. The ***adaptability composite*** scale describes the ability to envision experiences objectively, while also being able to adjust thought and behavior and generate solutions.
5. Finally, the ***general mood*** composite scale determines a person's ability to look on the bright side and have fun.

### **Competing Value Framework Theory**

Much like emotional intelligence, the Competing Value Model (CVM) and the commonly known Competing Values Framework (CVF) have also been great topics of discussion within numerous business circles. The CVF was derived from the CVM and has been recognized as one of the 40 most significant models utilized in business history (Quinn, 2004). Furthermore, this model is widely used in MBA programs throughout the world in addition to thousands of organizations for leadership and organizational analysis. CVF was originally based on empirical research into the origins of effective organizations. Quinn and Rohrbaugh (1983) determined that one dimension is related to an organization's internal effectiveness, and another to the external focus of the organization.

Quinn and Rohrbaugh (1981) noted that organizational effectiveness has received considerable attention in literature, citing 13 sources focusing on this topic. However, despite including this prior research, the authors conceded that a common definition of effectiveness has not emerged and there is lack of agreement by organizational theorists. The CVF, much like other successful models, is based on prior decades of theoretical views on organizations.

According to Quinn and Rohrbaugh (1981), the history of the CVF instrument is based on the work of Lavin W. Gouldner, who proposed a rational and natural system model. From that beginning, W. Richard Scott subsequently added the open system model. After potential issues were raised, Cameron (1979), Steers (1975), and Campbell (1977) proposed that variables should be identified and their inter-relation determined. Following prior work from Campbell (initially 30 criteria of effectiveness), Quinn and Rohrbaugh refined



Campbell's indices with a diverse panel of academic research professionals. Through an extensive process of review and refinement, the new model of CVF was developed.

Subsequent to the development of the CVF, two exploratory studies were performed which revealed positive results. First, the panel participants performed a multidimensional scaling survey, and then a secondary study was performed with a volunteered participative group associated with *American Science Quarterly*. In both studies, the correlations remained high in which the criteria revealed only a slight alteration within their spatial context (Quinn & Rohrbaugh, 1983). A study by Ofori-Dankwa and Julian (2001) specifically identified competing values as an approach that, in part, captures a high level of theoretical complexity for organizational theory.

Much like emotional intelligence, the idea of defining organizational effectiveness is not embraced by all researchers. Steers (1975) challenged the value of the construct, and Hannan and Freeman (1977) added further scrutiny. Bluedorn (1980) argued that the construct should be eliminated (Quinn & Rohrbaugh 1983). However, Quinn and Rohrbaugh noted the positive results and cited a 15-year study of creativity by Rothenberg (1979) which concluded that approaches and discoveries, sometimes based on contradiction, lead to new theoretical directions. Quinn and Spreitzer (1991) referenced the work of Siehl and Martin (1988), which indicated that prior methods of qualitative-only approaches made it difficult to make comparisons across organizations. The CVF method of quantitative results would provide another avenue for comparison.

During the early 1980 time frame, an additional study was performed in an effort to determine practical application of the new framework. In 1981, an investigation into Employment Service (N=561) revealed 8 factors that parallel the dimensions of effectiveness

proposed in the CVF (Rohrbaugh, 1981). Rohrbaugh further concluded that the study indicated that there are reasonable indexes related to the 8 effectiveness criteria of the CVF.

Another study by Cooper and Quinn (1993) used the CVF for measuring effectiveness in Management Information System (MIS). This study also presented good correlation with practical application. Based on the results, Cooper and Quinn concluded that informational processing organizational theory and MIS characteristics demonstrated a link.

A subsequent 1999 study on CVF was performed by Kalliath et al. (1999) to determine structural relationships between the constructs of CVF. The authors noted that although the CVF's developers had used a variety of methods of investigation (multitrait, multidimensional scaling, etc.), an investigation using structural equations modeling (SEM) identifying variable locations in spatial format had not been performed. They subsequently used SEM with over 300 managers in a multi-hospital system and found that it compared well with the prior figures obtained by Quinn and Spreitzer (1991). In their discussion, Kalliath et al. (1999) stated that the results of their study supported the concept of organizational effectiveness and the CVF model (Quinn & Rohrbaugh, 1983; Quinn & Spreitzer, 1991) and provided further triangulation with a very strong method of analysis.

Paparone's (2003) dissertation investigating CVF cited numerous studies that used the CVF concept. Although he used another commercial assessment of CVF (Organizational Cultural Assessment Instrument, or OCAI), Paparone noted its first time use for his type of study. One item specifically mentioned was the concern of inferences of cultures based only on quantitative means. Paparone provided a reference of this concern (Schein) which

mentioned OCAI specifically. Similar to Paparone, it is important to note that, since such type of criticisms are important, this study did not rely solely on quantitative data.

### **Quinn's Theory of Competing Value Framework**

The CVF is a tool that can be used in various organizational contexts. It is able to review management, supervision, leadership roles, and culture, and examine organizational functions and processes, and view gaps. The name “competing value” makes sense due to the CVF’s combination of four different models that are at times in conflict. For example, although most people want organizations with creativity and flexibility, very few would like these attributes at the expense of stability and control. CVF is a concept that enables the visualization of various management theories (i.e., internal process, open systems, rational goal, and human relations). These four competing models fit into quadrants when plotted on two axes. Figure 2.1 illustrates the CVF as developed by Quinn (2003).

Flexibility appears at top, opposing control at bottom; internal is at left, versus external at right. On further representation, the following framework has four sections with two subsets each, and made of the following as adapted from Quinn et al. (2003):

1. ***Internal Process Model***: Based on *Coordinator* (which addresses management control and constancy), and *Monitor* (which incorporates certification and management of information).
2. ***Human Relations Model***: Based on *Facilitator*, addressing candidness and participation, and *Mentor*, for communication and morale.

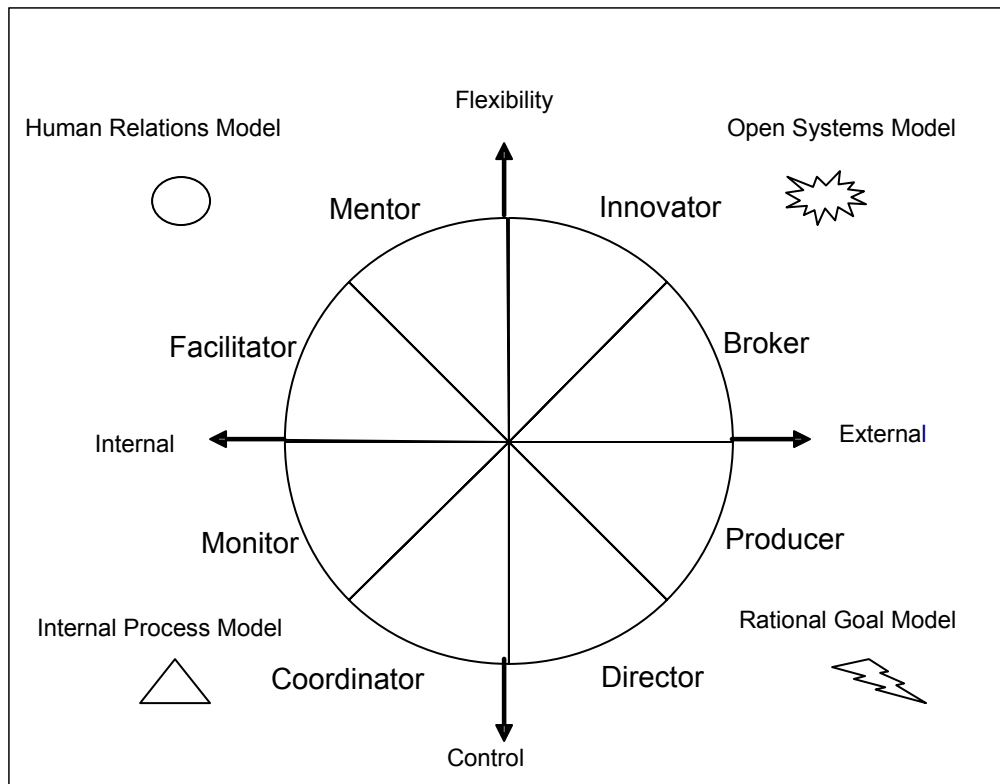


Figure 2.1. Competing values framework

3. **Open System Model:** Based on *Innovation* (which includes innovation and adaptability), to change *Broker*, addressing development and resource acquisition.
4. **Rational Goal Model:** Based on *Producer*, which includes output efficiency and accomplishment, and *Director*, which addresses leadership and objective clarification.

Similar to the Bar-On assessment, the Quinn, et al. assessment tool also has subcategory competencies. The roles, key competencies, and summarized descriptions are provided in Table 4.3 (Quinn et al., 2003).

Due to the amount of research, articles, and money spent on business development, it is evident that the topic of emotional intelligence, or soft skills, has a place in the

construction engineering business. Contrary to a person's cognitive abilities, this area of human skills looks for measures of each person's potential success through assessments that determine the person's emotional intelligence. Due to the various numbers of assessment tools, and its previous acceptance by organizations, it appears that, as revealed by Daus and Ashkanasy (2005), these types of tools are here to stay.

### **CHAPTER 3. HYPOTHESES**

This chapter focuses on the issue of measurement. The previous chapter revealed that there is a broad consensus that soft skills are vital to engineering graduates. Thus, there is a need to determine how to measure whether specific soft skills facilitated in a classroom environment are learned by the students. The following sections describe how specific skills were measured by using the EQi inventory, and the CVSS assessment within the CVF framework competencies assessment tools. Three hypotheses were proposed in this research.

#### **Research Questions**

In the 1950s, the United States shifted from a practical to theoretical treatment of teaching math and sciences (Roesset & Yao, 2002, Sinha et al., 2002). This shift away from practical to theoretical significantly affected the method in which students were taught. The contents of the curricula paid more attention to theory which was generally taught by the lecture method. Little attention has been paid to sociopolitical, communication, and team working skills (Roesset & Yao 2002). As a result, more graduates are under-equipped to enter the workforce, and need more hands-on training to work effectively in teams (Davies et al., 1999). Educational opportunities that enable open-ended problem solving through successes and failures are the principles for teaching creative behavior (McGraw, 2004). It has been revealed in prior research that appropriate teaching methods can provide an educational improvement of up to four times (Cohen, 1987). Would active learning such as PBL be such a bridge? Could this method be implemented for all engineering courses? According to Coll and Zegwaard (2006), behavior skills are difficult to develop and measure.

The current study explored whether the application of PBL teaching methods affect students' learning processes. Prior research has posited that PBL is an effective teaching technique; however, it was not apparent whether studies related to engineering have tested this technique to establish that the competencies identified as critical by professional and academic sources will change students' competency in soft-skills. This research tested change in three specific competency groups:

- Confidence and stress coping skills;
- Leadership and communication skills; and
- Adaptability and management skills.

The following research questions guided analysis in these areas:

1. Will the participants experience a difference or change in the initial (pre-test) and final (post-test) levels of some competencies?
2. How do these competencies change during the semester?
3. Is the change related to PBL?

Another dimension of inquiry that was used to evaluate the research questions was the availability of open-ended responses. Since the questions could not be formally tested, a review of the themes was generated based on the responses from this inquiry. This procedure and method is further described in the qualitative section in Chapter 5.

### **Hypotheses**

Based on the research questions, the following hypotheses were proposed to test the impact of PBL methods:

1. PBL will increase confidence and the ability to cope under stress.

2. PBL will improve leadership abilities and communication skills.
3. PBL will develop adaptability and management skills.

The basis for selecting specific soft skills is discussed in detail in the following sections.

*Hypothesis 1: PBL will increase confidence and the ability to cope under stress.*

The EQi practitioner's handbook provides guidance for defining this hypothesis. According to Lopez (2005), Bar-On and staff identified several subscales, such as assertiveness and stress tolerance that have meaningful correlations with behavioral outcomes. The importance of subscale assertiveness was identified by Stein and Book (2000) as one of the key factors in work success. According to Bar-on (2005), and Stein and Book (2000), assertiveness is by no means a negative connotation; rather, it is associated with confidence and can also be described as stating one's beliefs confidently with careful consideration and empathy to others. Due to the association between assertiveness and confidence, the word "confidence" was selected for use as the first subcategory due to its commonality and more familiar connotation.

The second Bar-On subcategory, stress tolerance, measures the ability to positively cope with stressful situations and circumstances. In essence, stress tolerance indicates a more optimistic view toward change whereby the individual remains calm in stressful situations. In order to focus appropriately, a person must initiate and deal with his or her emotions (Sprengler, 1999). Persons who become too emotionally inundated experience challenges in creative and analytical thinking and subsequent lapses in making decisions, recalling, and learning (Dirkmann & Stanford-Blair, 2002). Learning how to recognize that one can control and influence the situation can provide a powerful tool for success.



While Norman and Schmidt (2000) argued that PBL can provide an improved level in student attitudes, other researchers (Bernold, 2007; Prince, 2004, Prince & Felder, 2006, Yeo, 2005) noted challenges that may occur because students are not familiar with PBL methods and, thus, experience stress. This hypothesis tested if the student's ability to cope with stress does change.

*Hypothesis 2: PBL will improve leadership abilities and communication skills.*

Although leadership is difficult to learn in an educational setting (Densten & Gray, 2001) and obtaining gains in effective communication is challenging (Yeo, 2005), researchers have argued that these skills are best taught through the use of PBL (Ribeiro & Mizukami, 2005). The second hypothesis investigated this question.

According to the Quinn CVF (Quinn et al., 2003), a person who exhibits leadership has the ability to develop vision for a team by setting objectives and organizing the necessary means to obtain the goals. However, an effective leader should not appear too unreceptive to the feelings of others. Instead, the person should balance leadership capabilities with strong communication skills and people skills. Badger (2007) has commented that leadership is directly associated with people and their respective relationships. This view is further supported by the notion that better performers excel in teamwork and collaboration (Caudron, 1999).

As project managers spend more than 70% of their time on communication (Goodwin, 1993), the importance of the humanistic side of people should not be discounted. Qualities desired of leaders such as listening, being considerate, and providing opportunities

through delegation are typical characteristics. Therefore, in order to be effective, a person must lead with sufficient balance to mentoring and people skills.

*Hypothesis 3: PBL will develop adaptability and management skills.*

Creatively dealing with change is the ability to adapt to the environment while seeking intuitive insights and ideas that open the mind to solutions for problems. In essence, this relates to the flexibility side of the CVF model as a person uses creative avenues and adapts to changes. Recognition, attention, and subsequent adaption to a changing environment enable a person to better tolerate uncertainty and risk. According to the model, this risk must be tempered with the control aspects of the management and teamwork skills. These skills indicate the ability to provide value in identifying inefficiencies, and to work effectively in cross functional teams to reduce or eliminate problems. This aspect of interaction involves providing the necessary control and steadiness to assure the structure and flow of work. Organizational skills, time management, multitasking, and successful overview of the system with effective communication are typical attributes. Hypothesis 3 investigated the interaction of PBL with this desired balance.

## CHAPTER 4. METHODOLOGY

The EQi and CVSS assessment tools were selected as valid assessment instruments that can be used to measure changes in specific student aptitudes and abilities. Although these tools can establish a change, they do not indicate the source of the change. The tools may show that a change has occurred between the beginning and end of the course, but they cannot determine if the source of the change was the course or an outside factor. More specifically, the participants who were students in Con E 461 were graduating seniors and shared many other common experiences from other classes and extracurricular activities. The need to make clear associations to determine causation is one of the factors that make research with human subjects challenging.

One possible course of action is to establish a control group. Unfortunately, control groups also have drawbacks, such as reducing the number of subjects available for testing. If the two groups are operating during the same semester, then there would be substantial challenges in keeping the students from each group from exchanging information. However, if the groups do not operate simultaneously in the same environment, then external factors would differ between them, which would negate the benefits of the control group. Fortunately, there is another solution to this problem, which is to adopt a mixed design methodology.

In mixed design research, quantitative and qualitative data are collected and analyzed together (Creswell, 2003). The mixed design method helps verify changes. Quantitative data cannot determine if changes occur from within or without the course. While qualitative information provides additional explanations of the students' thoughts, such information is

difficult to quantify. For this reason, a mixed design method was adapted in this study in which students' written reflections were used to verify that the measured changes occurred within the class.

The following data collection strategy was adopted for this research. The study examined two separate semesters in an accredited construction engineering program. A pre-test/post-test design was used to gather quantitative data to measure change over two semesters, thereby enlarging the data set and making it possible to show a trend. These quantitative data were supplemented with written reflections from the participants, as the additional ability to reflect has been partly identified as a characteristic that will take learning to a higher level (Yeo, 2005). This method is known as triangulation (Creswell, 2003). As shown in Figure 4.1, quantitative and qualitative data enable researchers to perform concurrent triangulation.



Source: Creswell, 2003, p. 214

Figure 4.1. Concurrent triangulation

Quantitative data are used to establish that a change has occurred, while qualitative data establish the source of that change. Using triangulation enables the researcher to be more comprehensive and provide a clearer picture (Neuman, 2000). It also increases trustworthiness (Leydens et al., 2004).

### **Definition of Terms**

The following terms frequently employed in educational research were used in this study:

*Correlation:* A measurement of the relation between two or more variables and helps identify the slope. It is unrelated to the units of measurement and must fall between  $-1$  and  $+1$ .

Furthermore, the higher the quantitative value, the stronger the strength of linear association (Agresti & Finlay, 1997, pp. 319, 320).

*Cronbach Alpha:* A statistically recognized reliability score that assists a researcher in determining strength of reliability. Higher values imply that responses are similar across a set of items, and thus that results are replicable in multiple measurements. Nunnally (1997, p. 245) recommended that basic research has a reliability score of approximately .70 or better.

*Dependent Variable:* The variable which is affected upon by the independent variable. In an experiment investigating studying, studying would be the independent variable and grades the dependent variable (Babbie, 2001, pp. 7, G3).

*Goodness of Fit:* “The test for the log linear model which states that the two categorical variables are statistically independent” (Agresti & Finlay, 1997, p. 594).

*Independent Variable:* The variable which is the cause of the dependant variable. In a studying experiment, studying would be the independent variable and grades the dependent variable (Babbie, 2001, pp. 7, G5).

*Normal Distribution:* A bell-shaped curved used to assist in determining probability to variables as they relate to statistical inference.

*Normality:* A test to determine if the statistical method is robust in respect to a t distribution with numbers less than 30 (Agresti & Finlay, 1997, p. 186).

*Posttest:* Participants are measured to determine dependant variables subsequent to the expose to independent variables (Babbie, 2001, pp. 218, G8).

*Pretest:* Participants are initially measured to identify initial dependant variable values prior to exposure to independent variables (Babbie, 2001, pp. 218, G8).

*Probability:* The portion in the tail of the tail of a normal distribution to assist in determining the significance of the test. Most studies require  $p$ -values  $\leq .05$  (Agresti & Finlay, 1997, pp. 158, 192). For this study,  $.05 < p \leq .10$  indicates suggestive;  $.01 < p \leq .05$  significant;  $.001 < p \leq .01$  strong; and  $p \leq .001$  convincing.

*Reliability:* The ability to replicate the same results through the use of a specific technique. The analogy is similar to having a “tight pattern” on a bull’s eye, however not necessarily on the bull’s eye itself. The reliability is related to the consistency of the shot (Babbie, 2001, pp. 140, 144).

*t Distribution:* A specific statistical tool developed to determine inferential analysis for small samples of approximately less than 30 (Agresti & Finlay, 1997, p. 180).

*Triangulation:* A procedure of using a variety of research methods to examine or observe data from multiple sources (Babbie, 2001, p. 113).

*Validity:* Informs whether the measurement is accurately identifying the concept it is intended to measure. Therefore, in the bull's eye analogy, validity is the pattern that the shots are arranged around the center of the target, or the indented bull's eye (Babbie, 2003, pp. 143, 144).

### **Institutional Review Board Approval**

Prior to conducting the study, application for approval to conduct research involving human subjects was submitted to the Institutional Review Board Office of Research Assurances at Iowa State University (ISU). A copy of the approval appears in Appendix A. In order to protect the confidentiality of the participants, the qualitative material was placed in a confidential location. In order to further provide additional anonymity, numbers were used in order to provide identification and reference to participants' comments.

### **Participants and Sample**

The participants were undergraduate students in the senior capstone class (Con E 461) during the Fall 2005 and Spring 2006 semesters. This single-semester class was designed to use PBL techniques throughout both semesters of the study. This method of delivery employs an intensive team-based exercise that simulates typical experiences of construction industry professionals.

This study used a pre-experimental pre-test/post-test design (Creswell, 2003) with two separate quantitative assessments: (a) Bar-On EQi 133, based on emotional intelligence theory, and (b) Competing Values Skills Survey (CVSS) which is modeled on the CVF. The researcher also gathered finalized written statements from the participants for the qualitative portion. Furthermore, since this course was a graduating requirement for all students, the

students enrolled in the classes were representative of the senior population in the program during the F05 and S06 semesters.

The current researcher was the instructor for these courses. He has over 20 years of industry experience, has taught this course since fall 2001, and students were typically aware of this fact. Therefore, the possible difference in instructors would be not applicable to this study. Prior research has argued that there are negative effects with facilitators who lack expertise (Prince, 2004).

Due to human subject considerations, the research design adopted the criteria of a prior study conducted by Zolin et al. (2003). All students were considered to be in the experimental group and given the same instruction to enable them to experience the same learning opportunities. This process provided assurance that involvement would be of no advantage or disadvantage to the students. Prior to conducting the study, the research design was submitted to the Office of Institutional Research Board at Iowa State University (IRB) for review and approved. As stated earlier, a copy of the approval appears in Appendix A.

Students attending the class were not informed of the opportunity for participation in the study until the first day of class. When the students were informed, they had the opportunity to decline involvement or complete the necessary agreement to voluntarily participate as a human subject in the research study. Students who chose to become involved and completed the paperwork were provided access to websites and computer codes (as required) to complete the pre-test. They were further informed that, since this was voluntary, they could elect to withdraw at anytime. Since the semester was 16 weeks, and a post-test was required at the end, students were requested to complete their pre-test assessments prior to the end of the first week. This allowed for potential enrollment changes during the first



week of class, and also fit within the prior re-test data period for the Bar-On (2005) assessment tool. The complete syllabus for S06 appears in appendix B. The stated course objectives were as follows:

The objectives of this course were to:

1. Demonstrate competency in all phases of project planning, engineering, and management at the project level.
2. Understand and handle the uncertainties involved in planning and decision-making, for project situations and organizations.
3. Understand the relationships between decisions of the owner, designers, and contractors.
4. Demonstrate methods of written and oral communication within the work environment.
5. Demonstrate effective skills and accomplishment of complex and challenging objectives.
6. Experience different formats of communication techniques (added S06).

Since the students were allowed to decline acceptance and reconsider continuance of this study at a later date, this research only analyzed quantitative data that were available for the pre-test and post-test. In addition, although students in both semesters provided various written reflections throughout the class, only the final reflections and a senior response sheet authorized for the study involvement were analyzed in this study. The review of prior reflections (written as class progressed) appeared to reflect a similar pattern identified in the final reflections.

Since the goal of PBL is to provide realism, this class emulated experiences similar to that of the real world setting in construction engineering. In this study, the use of a classical control group was not considered since all students were allowed to experience this unique learning opportunity in a real world environment. This technique can have a great advantage over other study methods. Babbie (2001) noted that, due to their artificiality, laboratory type experiments are questionable. The social processes may not be as strong as settings in a natural, real-world environment.

Zolin et al. (2003) further stated that the problem-based learning method can provide value over other methods since it has the best balance of realism and control. Their article further demonstrated the PBL advantage over experimental, semi-natural, and natural styles of study, and identifies PBL's other advantages as realism and balanced control.

Since variations in problems or projects can create issues regarding the review of the student, groups ranging from a low of four to maximum of seven, were provided for the same assignments. This further ensured that the level of difficulty, opportunities for interactions, potential for unique designs, solutions, and innovative techniques would be essentially the same variants for this research. The PBL setting varied from the performing of a multitude of various assignments in bidding, marketing, estimating, scheduling, and management in an effort to enable the students become accustomed to the multi-tasking necessary in the real world as construction engineers. The final task was for each group to design, market, estimate, schedule, and defend its solution for projects that had similar program plans.

During this study, the students were allowed to choose their own groups. This type of selection replicated what most would be experiencing while interviewing for a job, and provided the students the opportunity to make the same types of decisions and react to those

decisions, similar to what they would be doing on a professional basis. Since the students' emphases in construction engineering varied, from building, heavy, mechanical and electrical emphasis, they tended to equalize the skill distribution and effectively produced a natural, balanced skill level, further reducing the potential for bias (Zolin et al., 2003) and creating the opportunity for cross disciplinary teams.

### **Class Activities**

The Con E 461 class provided the students an opportunity to learn in a PBL environment. As an indicator of PBL, the class followed a student-centered pattern of learning in which the students took an active role in their education (Bernold, 2007) in which the problems encountered introduced a self-directed learning (Roselli & Brophy, 2006). This PBL atmosphere was further enhanced and defined as the learner was placed at the center of learning whereas the teacher played the role of facilitator (Yeo, 2005) while maintaining activities in an ill-structured format (Prince & Felder, 2006). Furthermore, this learning environment provided problem-solving solutions which incorporated aspects of marketing, design, estimating, planning, and scheduling as the students progressed through the semester-long course as a team which also comprised normal PBL criteria (Zolin et al., 2003).

In order to provide an overview of some of the activities that students carried out in active roles, a brief overview of activities follows. As the students engaged in teams in this ill-structured flexible learning environment, the instructor maintained the role of facilitator as part of the PBL process (Kumar & Hsiao, 2007).

**Conceptual project**

Initially the class was typically introduced to a small conceptual estimating project that required a deliverable product in less than a week. The project was an ill-defined cubic concrete structure in a 3-D CAD drawing format. This vaguely described project had two levels and various multiple patterned holes throughout the structure. The task for each team was to brainstorm and develop an efficient and cost-effective system for the project. Once the system was determined, the necessary quantity survey, estimating methodology, and schedule had to be delivered in a professional format to a fictitious client. Each team was allowed creative opportunity to develop its most innovative solution.

**Residential project**

Another assignment was to perform an estimate for a basic small residential type project. This slightly less than 2,000 square foot facility was to be based as a house which was to be built in Ames, Iowa. Similar to the competitive nature of the conceptual project, each team had to submit a total cost and schedule within a short, specified time period. During this process, students were required to become acquainted with the project to a level to compare and properly evaluate subcontractor and supplier bids. Prior to the final cost quotation, the students received and evaluated fictitious ill-defined supplied quotations within a limited timeframe. After these documents were provided, the students in each team utilized their own self-designed estimating system for finalizing the quotation.

**Qualification and marketing package**

As marketing is an important component of the construction industry, each team was required to demonstrate its marketing ability in a bound presentation format. This package

included the information of their fictitious company. Components such as a brief company history, organization description, hierarchy of individuals, summarized industry experience, services available, and systems were some of the items provided. Each team was required to determine its own focus, scope, direction, and solution.

### **Commercial project**

During the semester the class as a whole selected and pursued a project in the local area. The task was to estimate, plan, schedule, and bid a sizable project, varying in cost from approximately \$500,000 to \$20 million. This challenge included receiving a complete set of contract documents and establishing procedures to follow and implement within divisions of small groups in order to provide a successful bid. Components such as attending a pre-bid meeting, meeting and coordinating with suppliers and subcontractors, were integral parts of the learning experience. Once the process of contacts was determined, students implemented best practices to developed preliminary schedules and review costing. Areas such as avenues of communication, leadership and delegation, timelines (contractually set and self imposed) came into play as the students took active roles in their own learning as solutions were required for costing, scheduling, labor, equipment, sub and supplier coordinating, site planning, and the successful assemblage of their overall project.

### **Design project**

Although each of the previous activities provided a multitude of issues for the students to recognize and successfully resolve, the final project provided additional challenges for the students. The instructor presented an actual site that students in small teams could access to complete a fictitious design project. Other than providing the actual

site, and a soil data which were to be applied to the site, the conjured project was very open-ended. Through class discussions the finalized scope of the project was determined by students within teams (the instructor facilitated and assisted to document outcomes), in which each team provided its best solution. Through knowledge gained in previous classes, individual research on code requirements, each team of students was challenged to provide a cost-effective, fully scheduled facility for a fictitious client. In order to accomplish this task the students determined the minimum requirements of items for presentation so that a client would be able to view the architectural, structural, electrical, mechanical and other plans and sections to envision the project. Each student team was then provided time to propose and implement its own best method of attack to accomplish this monumental task. Building themes, schedules, plans, and costing were integrated as creative practice. In order to accomplish this task, students within teams determine roles, responsibilities, timelines, and assessments based on qualifications, management systems, and approach. After the teams developed a solution they were presented an opportunity to attempt to sell their projects to a jury. The jury consisted of a variety of professionals (industry, professors, and alumni) who subsequently had the students describe their choices, provide insight to their methodology, and offer further insight regarding their challenges and solutions.

Although the students were provided an opportunity to modify their groups, the students elected to stay within their groups both semesters. This lack of desire to change was similar to prior experiences, and added continuity throughout the study. During the 16 weeks, students became acquainted with numerous facets of PBL techniques such as role-playing, case method, games and simulations (which enhanced their level of motivation), thinking skills, and likelihood to place best practices into memory (McKeachie, 2002).

This class was specifically set up to integrate knowledge gained in several of the students' prior classes into a challenging experience which would encompass practice in areas of leadership, teamwork, decision-making, creativity, ethics, interactions, management, communication, and interactions in an ill-structured, active student learning environment. Since real circumstances and experiences were prevalent throughout the class, it provided an opportunity for professional growth in an educational setting.

### **Bar-On Assessment Tool**

The Bar-On EQi 133 has been used to measure emotional intelligence within individuals and organizations. Although there were other EQi assessment tools available (EQi 125, EQi short version, EQ-360), the EQi 133 was selected due to its extensive questions, online administration, and prior research support. The EQi 133 is the first empirically constructed assessment of emotional intelligence based on prior research that has been made commercially available, and has been used in previous educational, clinical, medical, business and management science research (Bar-On, 2005).

Furthermore, additional advantages of the Bar-On include a statistical database of over 4,000 participants (suitable for any gender 16 years or older), over 17 years of prior extensive research, various validity and adjustment factors, international implementation and recognition, and a multidimensional scope of composite and subscales. The EQi is comprised of 133 items based on a five-point ranking system that provides responses from "very seldom" or "not true of me," to "very often true of me" or "true of me." Through these responses, the instrument provides a total EQi score, 5 composite category scale scores, and 15 subscale results. An overview of this assessment is briefly provided in Table 4.1.

Table 4. 1. Bar-On EQi scales, subscales, and definitions (adapted from Bar-On, 2005)

Components	Definitions
<b><i>Intrapersonal</i></b>	<i>The ability to:</i>
Self-Regard	...be aware of, understand, accept, and respect oneself .
Emotional Self-Awareness	...properly recognize and understand one's emotions.
Assertiveness	...feel confident and express beliefs, feelings, and thoughts nondestructively.
Independence	...feel comfort in self-directed control of one's thoughts and thinking.
Self-Actualization	...realize one's potential capacity and endeavor to perform what one enjoys.
<b><i>Interpersonal</i></b>	<i>The ability to:</i>
Empathy	...read, understand, and appreciate the feelings of other people.
Social Responsibility	...contribute, cooperate, and be a constructive member of society.
Interpersonal Relationship	...establish strong relationships, closeness, and provide and receive emotional interactions.
<b><i>Stress Management</i></b>	<i>The ability to:</i>
Stress Tolerance	The ability to cope with stressful situations, events, and strong feelings confidently.
Impulse Control	The ability to delay or avoid the temptation or impulse to immediately act.
<b><i>Adaptability</i></b>	<i>The ability to:</i>
Reality Testing	...distinguish between what objectively and subjectively exists.
Flexibility	...effectively adjust one's emotions, thoughts, and behavior to the situation.
Problem Solving	... identify, define, and provide potentially viable solutions.
<b><i>General Mood</i></b>	<i>The ability to:</i>
Optimism	... view a positive side of life.
Happiness	...enjoy and be satisfied with oneself, and being with others.

Table 4.2 reveals how various EQi scores are interpreted based on the Bar-On EQi technical manual (BarOn, 2005). The EQi online raw scores are automatically changed to standard scores so that each composite scale and subscale has the same mean (100) and a standard deviation (15). In addition, the assessment program adjusts raw scores through gender and age information. This method brings further strength to the tool since a large



Table 4.2. Interpretive guidelines for EQi scores

Standard Score	Interpretative Guidelines
130+	Markedly High—atypically well-developed emotional capacity.
120-129	Very High—extremely well-developed emotional capacity.
110-119	High—well-developed emotional capacity.
90-109	Average—adequate emotional capacity.
80-89	Low—underdeveloped emotional capacity, requiring improvement.
70-79	Very Low—extremely underdeveloped emotional capacity, requiring improvement.
Under 70	Markedly Low—atypically impaired emotional capacity, requiring improvement.

Source: Bar-On, 2005; permission to reproduce granted by Multi-Health Systems (MHS).

statistical EQi database is available to support the findings. For example, a score of 90 – 109 indicates an adequate level of emotional capacity.

During the assessment's development, numerous statistical analyses were performed in respect to reliability and validity. The Cronbach alpha was investigated to assess reliability which revealed average alpha values of internal reliability ranging from 0.69 (Social Responsibility) to 0.86 (Self-Regard), with an overall internal consistency coefficient of 0.76 (Bar-On, 2005). Re-test reliability was 0.85 after one month and 0.75 after four months. These results indicate good reliability since the scores had a reliability score of approximately .70 or better (Nunnally 1997, p. 245).

Validity assessments of the Bar-On were also performed in order to establish correlations and determine how well various scales or subscales assessed to ten other tests provided in six tested countries. Since validity is a check to determine if the measurement accurately identifies the concept it is intended to measure, several checks were performed against prior assessment tools. For example, in the subscale stress tolerance, the EQi

correlated well with another prior assessment tool, Sixteen Personality Factor Questionnaire, revealing 0.67 (emotional stability) and negative 0.60 (apprehension) for the North American sample. The Bar-On also demonstrated negative correlations with the assessment tool, Beck Depression Inventory, revealing negative 0.41 and negative 0.60 on the Short Acculturation Scale. These results are significant as depression and anxiety are often symptoms associated with the inability to deal with stress (Bar-on, 2005). Thus, these robust Cronbach alpha correlations for the reliability and validity checks indicate that the EQi is a valid assessment tool.

Since Bar-On (2005) recommended that the EQi be used in conjunction with other assessment methods, it was determined that the second assessment tool, CVSS, would bring a strong business orientation to the current research. In addition, in the current study, the business perspective enabled the researcher to further identify specific business-related soft skills of construction (Klinger, 1956) and was used (in addition to the qualitative findings) to add additional validity to the study (Leydens et al., 2004).

### **CVF Assessment Tool CVSS**

The second instrument utilized was the CVF tool, CVSS, which has been widely used in numerous MBA programs and worldwide organizations, and integrates concepts in management theory. Because the CVSS is a multifaceted tool, it has been used as an investigation and teaching tool for cultures, managers, leadership, and organizations to determine and understand various business processes. Ofori-Dankwa and Julian (2001) argued that the CVF is an exceptional tool that can provide superior analysis that other less powerful models are unable to equal. Furthermore, it has over 20 years of use, worldwide

recognition and acceptance, is used in various academic studies, and includes multiple subscales.

Since the CVF model has been acknowledged as an important model in business history (Quinn, 2004), it also is comprised of various other assessments derived from theory. The CVSS assessment is available online and is tied directly to various managerial functions that are directly associated with and provided by Quinn et al. (2004), an original founder in the theory, therefore, it was implemented in the current study. The CVSS is comprised of 36 generalized statements based on a seven-point response system, from “almost never” to “almost always.” This section is followed by an additional 120 statements that are also based on a seven-point response system, from “strongly disagree” to strongly agree.” Through these responses, the instrument provides 8 role scores, and 24 competency results. An overview of this assessment is summarized in Table 4.3.

The CVSS online scores are automatically developed and can be readily printed for storage for future use. The scoring is based on a minimum value of 1, to a maximum value of 7 for the 24 competencies previously described. This allows the data to be assembled and studied in various formats for further analysis. For example, a score of 7 for Managing Change would indicate a maximum score for the open system’s innovator role of understanding and providing avenues of changes to achieve collaborative strategies.

Similar to the EQi, subsequent to the development of the CVF, several studies were performed to review its effectiveness to determine reliability and validity. During the exploratory conception, a multidimensional scaling was performed to determine goodness-of-fit and other correlations for expert review. The overall correlation of distances was 0.72,

Table 4. 3. Summary of managerial leadership and competencies

Model <sup>a</sup>	Role <sup>a, b</sup>	No.	Competency <sup>a</sup>	Summarized Competency Description
1-Human Relations	Mentor Role—Focuses on people's needs and attempts to balance employee requests with the growth of individuals.	1	Understanding self and others.	Developing awareness of self awareness, self assessment, and self confidence.
2-Human Relations	Mentor Role	2	Communicating effectively.	Providing positive interpersonal communications through empathetic techniques of reflective listening, discussion analysis, and following rules of effective communication.
3-Human Relations	Mentor Role	3	Developing employees.	Realizing and implementing delegation through proper responsibility, accountability, authority, and performance evaluations.
4-Human Relations	Facilitator Role—Provides avenues for open exchange of opinions and ideas while seeking consensus and minimizing potential conflict.	1	Building teams.	Assisting the group to develop a common goal, using roles and responsibilities, information sharing, accountability to identifying areas of good performance, needs of improvement, and barriers to improvement.
5-Human Relations	Facilitator Role	2	Using participative decision making.	Realizing and weighing the positive (technical knowledge, employee involvement, commitment, obstacles, buy-in) and negative (time, group balance, potential adverse meeting structure, risk of consensus) in order to increase effectiveness.
6-Human Relations	Facilitator Role	3	Managing conflict.	Reviewing different perspectives on conflict by seeing, being emotionally aware, reviewing potential action and providing positive outcomes and aftermath.
7-Internal Process	Monitor Role—Provides collection and distribution of information while providing constant checks and review of system feedback.	1	Monitoring individual performance or managing information through critical thinking.	Developing understanding and success in argument resolution through claim, grounds, and warrants.
8-Internal Process	Monitor Role	2	Managing collective performance and process or managing information overload.	Developing and implementing a method for information tossing, filing, and assemblage of message.
9-Internal Process	Monitor Role	3	Analyzing information with critical thinking or managing core processes.	Analyzing and improving flow-through by eliminating bottlenecks while mapping a process for improvement.
10-Internal Process	Coordinator Role—Focuses on obtaining solutions through standard structure, rules, scheduling, and coordination.	1	Managing projects.	Utilizing various schedule techniques such as work breakdown structure (WBS) and critical path method (CPM) to run planning processes.

Table 4. 3. (Continued)

Model <sup>a</sup>	Role <sup>a, b</sup>	No.	Competency <sup>a</sup>	Summarized Competency Description
11-Internal Process	Coordinator Role	2	Designing work.	Methodology for bringing together previously split assignments, increasing integration and self actualization through job enlargement, rotation, enrichment, and self managing work teams.
12-Internal Process	Coordinator Role	3	Managing across functions.	Ability to break down barriers and gain buy-in, goal collaboration, management through stepping out of roles, providing constant updates, training process, and clarifications of expectations.
13-Rational Goal	Director Role—Focusing on vision and leadership through goal setting, clarification of objectives, and determining mission.	1	Developing and communicating a vision.	Determining why an organization should exist by seeing the “big picture,” and developing and delivering a vision to life.
14-Rational Goal	Director Role	2	Setting goals and objectives.	Identifying what is needed to achieve and accomplish through performance management, reward, prioritized goals, action plans, and management by objective.
15-Rational Goal	Director Role	3	Designing and organizing.	Determining how best to achieve and accomplish goals and objectives through organization vision and strategy, and through dividing them into manageable components.
16-Rational Goal	Producer Role—Focusing on task and specific work items while guiding a team to completion.	1	Working productively.	Setting personal production and motivation by setting individual performance with empowerment and intrinsic motivation.
17-Rational Goal	Producer Role	2	Fostering a productive work environment.	Realizing, developing, and understanding important employee outcomes and leveraging these in individual and organizational approaches.
18-Rational Goal	Producer Role	3	Managing time and stress.	Recognizing and balancing conflicting demands of personal values, vision, and goals through clarification of values and support systems.
19-Open System	Broker Role—Aware of political environment while acquiring connections, items, and enhancement of external contacts.	1	Building and maintaining a power base.	Developing and influencing at an organizational level through persuasion that ideas, projects, values, and assumptions are of importance and valid.
20-Open System	Broker Role	2	Negotiating agreement and commitment.	Developing a method to separate the people from the problem while generating potential solutions based on objective standards
21-Open System	Broker Role	3	Presenting ideas.	Focusing on being able to present purpose to one’s audience by evaluating the climate, providing the necessary support, and then sequencing, accessing and polishing to be successful.

Table 4. 3. (Continued)

Model <sup>a</sup>	Role <sup>a, b</sup>	No.	Competency <sup>a</sup>	Summarized Competency Description
22-Open System	Innovator Role—Assists in producing a creative environment through fostering and encouraging change.	1	Living with change.	Ability to live with unplanned and unforeseen changes and visualizing primary, secondary, and fundamental choices with the power of purpose.
23-Open System	Innovator Role	2	Thinking creatively.	Utilizing lateral thinking to create a multitude of possible solutions by breaking away from common assumptions and barriers.
24-Open System	Innovator Role	3	Managing change.	Understanding and designing for changes through interactions to achieve collaborative and transforming strategies.

Source: Adapted from: <sup>a</sup>Quinn, et al. (2003); <sup>b</sup>Denison et al. (1995).

while the participants ranged from the high of 0.87 to the low of 0.64. These preliminary data were followed by additional review of 48 published participants of the *Administrative Science Quarterly*, who also provided additional support, with an overall correlation of 0.63 (Quinn & Rohrbaugh, 1983).

In a study in which the CVF was analyzed by 29 research members of the *MIS Quarterly*, the model had a correlation of 0.84 for capability characteristics and 0.79 for technical characteristics (Cooper & Quinn, 1993). These data seem favorable to another study on employment services ( $N=561$ ) that utilized additional validity through interviews, office reports, questionnaires, and provided magnitudes of reliability coefficients from 0.82 to 0.87 (Rohrbaugh, 1981). A slightly modified 1999 study which used structural equation modeling (SEM) indicated CVF results similar to prior studies, with alphas from the low of 0.80 to 0.90 (Kalliath et al, 1999). Overall, the aforementioned study's use of SEM was very successful and also indicated a goodness-to-fit value ( $GFI = 0.98$ ) for managerial data.

Finally, in a study focusing on the culture aspects of the CVF, a dual psychometric study using the OCAI (forced choice), and another which utilized independent measures that

were sent to 796 executives for public utility firms, the reliability (Cronbach alpha) varied between the minimum of 0.71 and the maximum of 0.79 for the OCAI, and 0.77 and 0.84 for the independent measures assessment (Quinn & Spreitzer, 1991). The aforementioned study, in addition to confirming reliability and convergent validity (impartial outside observer-Stein & Book (2000)), provided three tests for discriminate validity in which the analysis indicated convergent validity between the assessments, in addition to discriminate validity on the four culture scales. Similar to the EQi, the reliability and validity results for the business assessment tool were also convincing.

### **Data Collection**

The data collection process for this study entailed four methods of collection:

1. EQi—Emotional Intelligence assessment tool.
2. CVF—Competing Value Framework assessment tool CVSS.
3. Open-ended written reflections.
4. Partially closed-ended questions.

The quantitative assessment data collection took place during the 16-week semester. The first quantitative pretest was taken during the first week of class, and the post-test was taken at the end of the 16<sup>th</sup> week.

Qualitative written reflections were performed for various functions throughout the course; however, only the final written reflection collected at the end of the 16<sup>th</sup> week was used in this study. In addition, a portion of a partially closed-ended senior questionnaire was also collected at the end of the class and used for additional qualitative support. For the purpose of this study only the following portions of the senior questionnaire were used:

1. Do you think the Con E 461 course experience will be beneficial to you in your career?
2. What do you perceive as the biggest challenges that you will face in your career?
3. Other comments.

For two separate semesters, the senior capstone design class provided information for this study to help identify potential trends.

### **Limitations**

Learning style research is often questioned due to concerns of reliability and validity. As described previously, due to the interaction of various internal and external forces, the researcher can misidentify or misunderstand the factors that are affecting the learner. The challenges of reliability (the quality of measurement suggesting repeatability of the data), and validity (measuring the accuracy of the concepts investigated) can be a major point of contention. The current study had similar limitations regarding reliability and validity.

The scope of the study was confined to a very specific group of students who were enrolled in a senior capstone design course Con E 461. This study was designed to determine if this group of 2 semesters of graduating seniors, at or near one semester of graduation, would indicate change in their use of various soft skills. Results may not be replicable at other locations due to the students' stages in their academic careers, and prior educational background.

This study examined only two semesters of students enrolled in Con E 461 in the construction engineering program. The findings of this study may not be applicable to other engineering construction schools, particularly whose curriculum may be different in the



lower-level undergraduate classes. The study had a narrow focus in which the researcher hypothesized that the construction engineering students available would show measurable effects on usage of various soft skills.

There were several limitations to this study:

1. The data in this study were limited to the measures available in the portions used of the EQi and CVSS. For example, personalities measured by other assessments such as the Myers-Briggs Type Indicator (MBTI) might provide other inventories and were not available to this study. This limitation could restrict the ability to determine the indirect influence of personality on the students' potential changes in soft skills.
2. A second potential weakness of the study is that the data were collected for only one construction engineering program and, thus, do not allow for generalizations to other construction engineering programs.
3. The participants in this study were not randomized to eliminate bias, and the data provided could be identified with participants to organize the pre-test and post-test material. Thus, the participants reactions could be understated or overstated based on the sample method.
4. The participants' responses were collected at the end of the class and, therefore, may not fully identify the experiences or changes as the class progressed.
5. This study was limited to the variables investigated. Other soft-skill categories were intentionally not analyzed in this study.
6. Not all students elected to participate or continue with the study. For this reason, the number of participants varied by assessment.

7. For the quantitative portion of the study, two separate assessment tools were performed. Each of these tools included proprietary information; therefore, further investigation into the development of the data was performed in a black box type of setting.
8. During the qualitative portion of the study, and due to time restraints, there was no opportunity to further interact with the participants regarding their written comments.

Despite these limitations, this researcher attempted to minimize some of these limitations through methods described in the subsequent quantitative and qualitative sections.

### **Summary**

The purpose of this study was to investigate and identify certain soft skill changes that may occur due to PBL. Specifically, the method of mixed design and its implementation was presented. Included in this section were the methodology, the participants and sample, the assessment tools, data collection, and limitations.

## CHAPTER 5. DATA ANALYSIS

### Quantitative Statistical Significance

The purpose of this study was to gain a better perspective as to whether PBL affects certain soft skills of construction engineers. These soft skill competencies were addressed through three hypotheses.

This chapter provides the results of the quantitative data analysis used to investigate these three competencies. Hypothesis 1 examines change in participants for confidence and stress coping abilities. Hypothesis 2 investigates change in the soft skills of leadership and communication. Finally, Hypothesis 3 pursues change in participants' management and adaptability competency.

In order to follow a similar format of prior quantitative tools introduced in Chapter 4 (correlation, Cronbach alpha), the data were analyzed using the same tools for comparison purposes. The findings of this chapter are presented in five sections. The first section provides a brief overview of the descriptive data related to the participants. The second section provides a statistical check of the data for normality. The third section includes a summarized table of data correlations as they pertain to combined and individual semesters. In the fourth section, Cronbach alpha data are provided in table form along with a written review. To clarify the importance of the data, the fifth section presents a comparison of the mean difference,  $t$  value, and the respective  $p$  values (2-tail) provided for each hypothesis (in table and summarized form). The data for this section were compiled from the full quantitative data that appear the appendices. Finally, a summary is provided of the quantitative data.

## Overview

Fall 2005 semester (F05) included 22 students, of whom 2 were female. Of the 22 students available, ( $N=21$ ) elected to take the pre-test and post-test (EQi 133), ( $N=15$ ) the first set and ( $N=14$ ) the second set of questions (CVSS), ( $N=12$ ) the final reflection comments, and ( $N=15$ ) the senior response sheet.

Spring 2006 semester (S06) had 48 students, of who 3 were female. Of these 48 students, ( $N=37$ ) elected to take the pre-test and post-test EQi 133, ( $N=42$ ) the first set and ( $N=44$ ) the second set (CVSS), ( $N=47$ ) the final reflection comments, and ( $N=39$ ) the senior response sheet.

Combining the two semesters together provides ( $N=58$ ) for EQi 133, ( $N=57$ ) for the first set, and ( $N=58$ ) for the second set (CVSS). Note that during this testing procedure for S06, 2 students elected to take the EQi 133 post-test only, and one other student had testing validity issues. Per the recommendations in the EQi technical manual (Bar-On, 2005) and peer review, this student was deleted from the study. The remaining data were analyzed using the Statistical Package for Social Science (SPSS), version 15.0.

## Normality

Due to a limited number of participants during F05, a check on the  $t$  test for normal distribution was performed (Agresti & Finlay, 1997). As the observed values are plotted against the expected normal the tightness to the expected normal line can be observed. In order to investigate this question, SPSS was again utilized and peer reviewed in order to assure accuracy of the results. Subsequent to this review, the plot indicates that the data are normal and acceptable. The complete F05 plots for the pre-test values of assertiveness, stress

tolerance, designing and organizing, setting goals and objectives, and developing and communicating a vision plots are appear in Appendix D.

### **Correlation**

The correlation value is the measurement between two or more variables. The value has a restricted range from [-1, 1], with 1 as a positive left to right hand increase. In addition, two variables with a correlation of .80 would have a stronger linear association than variables with a correlation of 0.4 (Agresti & Finlay, 1997 p. 320). Correlation values along with the  $p$  values are provided in a summarized Table 5.1 by hypothesis. For evaluation purposes, the following key definition probability values were utilized:  $.05 < p \leq .10$  indicate suggestive;  $.01 < p \leq .05$  significant;  $.001 < p \leq .01$  strong; and  $p \leq .001$  convincing. The complete statistical analysis data appear for F05 appear in Appendix C (see C1 and C4, for S06 on C2 and C5, and for the combined on C3 and C6). Separating the sample by hypothesis and respective competencies indicated positive correlations of significant statistical value for the majority of the dataset.

The results of testing Hypothesis 1 indicated assertiveness and stress tolerance were highly correlated. Assertiveness was the most highly correlated competency in S06 (.718,  $p \leq .001$ ), with stress tolerance also highly correlated in S06 (.660,  $p \leq .001$ ). The data analysis for Hypothesis 1 indicated that the lowest reading for stress tolerance was F05 (.600,  $p < .01$ ), which is still statistically strong. For the combined data of F05/S06, both competencies had a statistical convincing significance of  $p \leq .001$ .

Hypothesis 2 testing results indicated that all but two F05 competencies (setting goals and objectives, and understanding self and others) received continuous and significant

Table 5. 1. Correlation results summarized according to hypothesis

Categories	F05 N=21 EQi N=14 CVF		S06 N=37 EQi N=44 CVF		F05/S06 N=58 EQi N=58 CVF	
	Corr.	Sig.	Corr.	Sig.	Corr.	Sig.
<i>Hypothesis #1—Confidence and stress coping</i>						
ASSERTIVENESS: CONFIDENCE	.632	.002	.718	.000	.679	.000
STRESS_TOLERANCE: COPING	.600	.004	.660	.000	.635	.000
<i>Hypothesis #2—Leadership portion</i>						
Designing and Organizing	.669	.009	.438	.003	.529	.000
Setting Goals and Objectives	.412	.143	.421	.004	.399	.002
Developing and Communicating a Vision	.725	.003	.664	.000	.678	.000
<i>Hypothesis #2—Communication portion</i>						
Developing Employees	.692	.006	.528	.000	.567	.000
Communicating Effectively	.567	.034	.634	.000	.617	.000
Understanding Self and Others	.093	.751	.448	.002	.348	.007
<i>Hypothesis #3—Management portion</i>						
Managing Across Functions	.661	.010	.479	.001	.526	.000
Designing Work	.575	.031	.423	.004	.465	.000
Managing Projects	.365	.200	.496	.001	.457	.000
<i>Hypothesis #3—Adaptability portion</i>						
Managing Change	.626	.017	.484	.001	.503	.000
Thinking Creatively	.700	.005	.580	.000	.606	.000
Living with Change	.592	.026	.545	.000	.550	.000

statistically positive correlations. Of the competencies addressed in Hypothesis 2, developing and communicating a vision received the highest consistent correlation. For example, the combined F05/S06 designing and communicating a vision (.678,  $p \leq .001$ ) was followed by communicating effectively (.617,  $p \leq .001$ ), followed by understanding self and others (.348,  $p < .01$ ). For the combined data, designing and organizing, developing and communicating a vision, developing employees, and communicating effectively all rated a

convincing difference of  $p \leq .001$ . Understanding self and others and setting goals and objectives also posted a strong statistical difference  $p < .01$ .

Hypothesis 3 analysis results also indicated all but one F05 competency (managing projects) displaying positive, significant statistical differences. In Hypothesis 3, thinking creatively was the most highly correlated in F05 (.700,  $p < .005$ ) for the adaptability competency, while managing across functions F05 (.661,  $p < .010$ ) had the highest correlation rating of the management portion. For the combined data of F05/S06, both competencies had a convincing statistical significance of  $p \leq .001$ .

For Hypothesis 1, the summarized correlations appeared to perform well when compared to other established documentation of assessments such as technical manuals, and material described in Chapter 4. In respect to Hypothesis 1, the studies combined the F05/S06 confidence (assertiveness) rating of .679, and performed better than the technical manual's listed .60 for the 16PF (Personality Assessment Inventory) and Factor E (Assertiveness) for North America. The study's combined stress tolerance rating of .635 was also close to the prior subscale correlation of the 16PF Factor C (Emotional Stability) of .67.

Hypothesis 2 also appeared to perform statistically strong ( $p < .01$ ) in regard to the summarized correlations. The combined correlations ranged from a low of .348 (understanding others) to a high of .678 (developing and communicating a vision). The .523 average of the Hypothesis 2 competencies stacks up fairly well when compared to the Chapter 4 *Administrative Science Quarterly* overall correlation of .63.

Finally, Hypothesis 3 also performed convincingly at statistically  $p \leq .001$  for the summarized correlations. The combined correlations ranged from a low of .457 (designing work) to a high of .606 (thinking creatively), with an average of .517 for the two

competencies. Similarly to Hypothesis 2, the average of .517 for Hypothesis 3 ranks well in comparison to the above prior overall correlation of .63, listed in Chapter 4 (*Administrative Science Quarterly*).

The correlation values appeared overall to be robust for all hypotheses tested. The reliability (Cronbach alpha) and two-tail *t*-test were also used to analyze the data.

### **Cronbach alpha results**

According to definition, the Cronbach alpha is a statistically recognized reliability score which enables the researcher to determine strength of consistency. Determining reliability is important since it is the ability to replicate the results through the use of a specific technique. Similar to having a “tight pattern” on a bull’s eye, reliability is related to the consistency of the shot (Babbie, 2001 pp.140, 144).

Table 5.2 provides a summary of Cronbach alpha results for soft skills by hypothesis. The complete Cronbach alpha statistical analysis data for F05 appear in Appendix C (see C8, C11, C12, C17, and C18, for S06 on C9, C13, C14, C19, and C20, and for the combined on C10, C15, C16, C21, and C22). Separating the sample by hypothesis and respective competencies indicated positive correlations of significant statistical value for the majority of the dataset.

In respect to this study, the combined value of Hypothesis 1 (confidence and stress coping) reached 0.834. This value is better than the overall Cronbach alpha value of 0.76 for



Table 5. 2. Cronbach alpha results summarized according to hypothesis

Category	F05	S06	Combined
Hypothesis 1—confidence and stress coping	.826	.845	.834
Hypothesis 2—leadership portion	.904	.883	.886
Hypothesis 2—communication portion	.754	.807	.796
Hypothesis 3—adaptability portion	.874	.902	.895
Hypothesis 3—management portion	.864	.823	.834

the EQi. For Hypothesis 2 (leadership and communication), the average combined value of 0.841 (leadership and communication averaged) also compares superiorly to the Chapter 4 minimum value of 0.71 and maximum value of 0.79 (OCAI). For Hypothesis 3 (adaptability and management), the combined average value of 0.865 (adaptability and management averaged) scores higher than the previously mentioned Cronbach alpha values in Chapter 4.

Once again, the study provided robust values. In respect to reliability, Nunnally (1997, p. 245) posited that basic research has a reliability score of approximately .70 or better. All values in Table 5.2 surpassed this number, while the combined data provided values near and/or exceeding 0.80.

### **Hypothesis testing**

For the hypothesis testing, tables were provided listing the mean difference (subtracting post-test from the pre-test; a negative indicates an increase), the *t* value (value used to determine probability), and the 2-tail probability number which related to the *t* value. Per prior analysis, the key definition probability values of  $.05 < p \leq .10$  indicated suggestive;  $.01 < p \leq .05$  significant;  $.001 < p \leq .01$  strong; and  $p \leq .001$  convincing; were utilized. Subsequent

to the analysis of each hypothesis, the final summary section provides a brief overview of the section and results.

### **Hypothesis 1: Confidence and the ability to cope under stress Confidence and Stress Coping**

Table 5.3 provides a summary of Assertiveness (Confidence) and Stress Tolerance (Coping). The complete statistical analysis data appear in Appendix C (for F05 on C1, for S06 on C2, and for the combined on C3). Table 5.3 reveals statistical differences of confidence and stress coping skills for F05, S06, and combined F05/S06. On average, post-test total skills increased for all participants during the study period. Of the two variables, paired *t* tests revealed statistically significant evidence between stress tolerance pre-test and post-test mean scores for S06,  $t(36) -2.324, p < .05$  and F05/S06,  $t(57) -2.737, p < .01$ . In respect to assertiveness (confidence) skill, the paired sample *t* tests indicated suggestive evidence between for S06,  $t(36), -1.990, p = .054$  and F05/S06 combined  $t(57), -1.943, p = .057$ .

Table 5. 3. Summary of Assertiveness (Confidence) and Stress Tolerance (Coping)

EQi 133	F05 N=21 Mean Diff.*	<i>T</i>	2-tail	S06		F05 and S06 combined			
				N=37 Mean Diff.*	<i>T</i>	2-Tail	N=58 Mean Diff.*	<i>T</i>	2-Tail
Pair 5 ASSERTIVENESS1 ASSERTIVENESS (CONFIDENCE)	-1.571	-0.701	0.491	-2.676	-1.990	0.054	-2.276	-1.943	0.057
Pair 13 STRESS_TOLERANCE1 STRESS_TOLERANCE (COPING)	-2.810	-1.422	0.170	-3.541	-2.324	0.026	-3.276	-2.737	0.008

*Assertiveness*: The ability to feel confident and express beliefs, feelings, and thoughts nondestructively.

*Stress Tolerance*: The ability to cope with stressful situations, events, and strong feelings confidently.

\*The mean difference was calculated by subtracting post-test from the pre-test; a negative indicates an increase.

## **Hypothesis 2: Leadership abilities and communication skills**

### **Leadership**

Table 5.4 provides a summary of leadership abilities and communication skills with a focus on Leadership. The complete statistical analysis data appear in Appendix C (for F05 on C4, for S06 on C5, and for the combined on C6). Table 5.4 shows the statistical differences of the leadership characteristics skills for the leadership characteristics of the hypothesis. Again, participants recognized an average increase in all post-test leadership competencies. In this control portion of the framework, in all three competencies, there were statistically significant differences for the paired  $t$  tests. In the designing and organizing competency, data indicated strong evidence for F05 ( $t(13)$ ,  $-3.097$ ,  $p < .01$ ), additional convincing evidence for S06 ( $t(43)$ ,  $-4.448$ ,  $p \leq .001$ ), and for F05/S06 combined ( $t(57)$ ,  $-5.423$ ,  $p \leq .001$ ). The setting goals and objectives competency also indicated statistically significant differences with F05 ( $t(13)$ ,  $-2.694$ ,  $p < .05$ ) and S06 ( $t(43)$ ,  $-2.116$ ,  $p < .05$ ). A strong statistical difference was indicated for the F05/S06 ( $t(57)$ ,  $-3.058$ ,  $p < .01$ ). In respect to the remaining competency, developing and communicating a vision, again statistically significant differences were obtained with F05 ( $t(13)$ ,  $-2.329$ ,  $p < .05$ ), strong evidence was determined for S06 ( $t(43)$ ,  $-2.712$ ,  $p = .01$ ), and convincing evidence in regards to F05/S06 ( $t(57)$ ,  $-3.439$ ,  $p = .001$ ).

### **Communication**

Table 5.5 provides a summary of leadership abilities and communication skills with a focus on Communication. The complete statistical analysis data appear in Appendix C (for

Table 5.4. Leadership abilities and communication skills based on Leadership (CVSS)

		F05			S06			F05 and S06 Combined		
<b>Leadership: Director</b>		N=14			N=44			N=58		
		Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail
		Diff.*			Diff.*			Diff.*		
Pair 1	Designing and Organizing1; Designing and Organizing	-0.657	-3.097	0.008	-0.559	-4.448	0.000	-0.583	-5.423	0.000
Pair 9	Setting Goals and Objectives1; Setting Goals and Objectives	-0.529	-2.694	0.018	-0.282	-2.116	0.040	-0.341	-3.058	0.003
Pair 17	Developing and Communicating a Vision1; Developing and Communicating a Vision	-0.300	-2.329	0.037	-0.255	-2.712	0.010	-0.266	-3.439	0.001

*Designing and Organizing*—Determining how best to achieve and accomplish goals and objectives through organization, vision, and strategy, and through dividing them into manageable components.

*Setting Goals and Objectives*—Identifying what is needed to achieve and accomplish through performance management, reward, prioritized goals, action plans, and management by objective.

*Developing and Communicating a Vision*—Determining why an organization should exist by seeing the “big picture,” and developing and delivering a vision to life.

\*The mean difference was calculated by subtracting post-test from the pre-test; a negative indicates an increase.

Table 5.5. Leadership abilities and communication skills based on Communication (CVSS)

		F05			S06			F05 and S06 Combined		
<b>Communication: Mentor</b>		N=14			N=44			N=58		
		Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail
		Diff.*			Diff.*			Diff.*		
Pair 5	Developing Employees1; Developing Employees	-0.529	-3.693	0.003	-0.295	-3.053	0.004	-0.352	-4.309	0.000
Pair 13	Communicating Effectively1; Communicating Effectively	-0.257	-1.618	0.130	-0.191	-2.012	0.051	-0.207	-2.555	0.013
Pair 21	Understanding Self and Others1; Understanding Self and Others	-0.400	-1.889	0.081	0.073	0.709	0.482	-0.041	-0.431	0.668

*Developing Employees*—Realizing and implementing delegation through proper responsibility, accountability, authority, and performance evaluations.

*Communicating Effectively*—Providing positive interpersonal communications through empathetic techniques of reflective listening, discussion analysis, and following rules of effective communication.

*Understanding Self and Others*—Developing awareness of self-awareness, self-assessment, and self-confidence.

\*The mean difference was calculated by subtracting post-test from the pre-test; a negative indicates an increase.

F05 on C4, for S06 on C5, and for the combined on C6). Table 5.5 displays a flexibility portion of the framework, and the statistical differences of the communication and delegation characteristics of the hypothesis. In this study, all but one (understanding self and others, from S06) indicated an average increase in the post-test competencies associated. Of these three competencies, only one (developing employees) out of three indicated a consistent statistical significance for the data provided. The developing employees competency correlated with strong evidence in F05 ( $t(13), -3.693, p < .01$ ) and in S06 ( $t(43), -3.053, p < .01$ ). Convincing statistical difference was discovered for the combined F05/S06 ( $t(57), -4.309, p \leq .001$ ). Although the communicating effectively competency indicated suggestive statistical difference for S06 ( $t(43), -2.012, p = .051$ ) and significant difference for F05/S06 ( $t(57), -2.555, p < .05$ ), it did not provide a significant statistical difference for F05. In respect to the last competency (“understanding self and others”) the data only registered a suggestive statistical difference for F05 ( $t(13), -1.889, p = .081$ ).

### **Hypothesis 3: Adaptability and management skills Adaptability**

#### **Adaptability**

Table 5.6 provides a summary of adaptability and management skills with a focus on Adaptability. The complete statistical analysis data appear in Appendix C (for F05 on C4, for S06 on C5, and for the combined on C6). Table 5.6 focuses on the flexibility portion of the framework and the ability to cope with uncertainty and risk creatively as change occurs. Once again, all three indicated an average increase in post-test competencies. In this section, nearly all three indicated a significant statistical significance for all portions (with thinking creatively excluded for F05). The managing change competency indicates significant change

Table 5.6. Adaptability and management skills based on Adaptability (CVSS)

Adaptability: Innovator		F05			S06			F05 and S06 Combined		
		Mean Diff.*	T	2-Tail	Mean Diff.*	T	2-Tail	Mean Diff.*	T	2-Tail
Pair 4	Managing Change1; Managing Change	-0.386	-2.448	0.029	-0.564	-5.123	0.000	-0.521	-5.683	0.000
Pair 12	Thinking Creatively1; Thinking Creatively	-0.200	-1.242	0.236	-0.441	-4.217	0.000	-0.383	-4.314	0.000
Pair 20	Living with Change1; Living with Change	-0.314	-2.409	0.032	-0.218	-2.209	0.033	-0.241	-2.982	0.004

*Managing Change*—Understanding and designing for changes through interactions to achieve collaborative and transforming strategies.

*Thinking Creatively*—Utilizing lateral thinking to create a multitude of possible solutions by breaking away from common assumptions and barriers.

*Living with Change*—Ability to live with unplanned and unforeseen changes, and to visualize primary, secondary, and fundamental choices with the power of purpose.

\*The mean difference was calculated by subtracting post-test from the pre-test; a negative indicates an increase.

for F05 ( $t(13)$ , -2.448,  $p < .05$ ), while convincing statistical difference was shown for S06 ( $t(43)$ , -5.123,  $p \leq .001$ ) and for F05/S06 ( $t(57)$ , -5.683,  $p \leq .001$ ). Although thinking creatively registered a convincing statistically significant difference for S06 ( $t(43)$ , -4.217,  $p \leq .001$ ) and for F05/S06 ( $t(57)$ , -4.314,  $p \leq .001$ ), there was not evidence of difference for F05 alone. In respect to living with change, there was significant statistical difference for F05 ( $t(13)$ , -2.409,  $p < .05$ ) and for S06 ( $t(43)$ , -2.209,  $p < .05$ ). However, there was a strong statistical difference indicated for F05/S06 ( $t(57)$ , -2.982,  $p < .01$ ).

## Management

Table 5.7 provides a summary of adaptability and management skills with a focus on Management. The complete statistical analysis data appear in Appendix C (for F05 on C4, for S06 on C5, and for the combined on C6). Table 5.7 provides an inspection into the control portion of the framework and the statistical differences in the management and teamwork competencies. As in several of the previous examples, all participants realized an

Table 5.7. Adaptability and management skills based on Management (CVSS)

		F05			S06			F05 and S06 Combined		
		N=14			N=44			N=58		
<b>Management: Coordinator</b>		Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail
		Diff.*			Diff.*			Diff.*		
Pair 8	Managing Across Functions1; Managing Across Functions	-0.871	-3.817	0.002	-0.905	-6.230	0.000	-0.897	-7.336	0.000
Pair 16	Designing Work1; Designing Work	-0.514	-2.261	0.042	-0.295	-2.413	0.020	-0.348	-3.236	0.002
Pair 24	Managing Projects1; Managing Projects	-0.457	-1.902	0.080	-0.195	-1.676	0.101	-0.259	-2.446	0.018

*Managing Across Functions*—Ability to breakdown barriers and gain buy-in, goal collaboration, management through stepping out of roles, providing constant updates, training process, and clarifications of expectations.

*Designing Work*—Methodology for bringing together previously split assignments, increasing integration and self-actualization through job enlargement, rotation, enrichment, and self-managing work teams.

*Managing Projects*—Utilizing various schedule techniques such as Work Breakdown Structure (WBS), and Critical Path Method (CPM) to run planning processes.

\*The mean difference was calculated by subtracting post-test from the pre-test; a negative indicates an increase.

average increase in all post-test management and teamwork competencies. All but one competency (managing projects) indicated a significant statistical difference for each combination reviewed. In managing across functions, there was a strong difference in F05 ( $t(13)$ , -3.817,  $p < .01$ ) and a convincing one for S06 ( $t(43)$ , -6.230,  $p \leq .001$ ), as well as for F05/S06 ( $t(57)$ , -7.336,  $p \leq .001$ ). Designing work indicated a significant difference in F05 ( $t(13)$ , -2.261,  $p < .05$ ) and in S06 ( $t(43)$ , -2.413,  $p < .05$ ). There was also a strong statistical difference shown for F05/S06 ( $t(57)$ , -3.236,  $p < .01$ ). Finally, although managing projects suggested a statistical difference for F05 ( $t(13)$ , -1.903,  $p = .08$ ) and S06 ( $t(43)$ , -1.676,  $p = .10$ ), there was a significant statistical difference for F05/S06 ( $t(58)$ , -2.446,  $p < .05$ ).

## Summary

This portion of the data analysis reviewed the quantitative results of the two assessment tools used. Subsequent to the review of the quantitative data (per the procedures

identified by the assessment tools), the data were prepared and run through statistical software (SPSS).

Once the data were organized and summarized into the hypothesis being analyzed, it was checked for normality. After passing a normality review, it was further evaluated for correlation and Cronbach alpha results. The reviewed data appeared to perform very well when compared to prior studies (Chapter 4) and to internal review.

In respect to Hypothesis 1 (confidence and stress coping), the *t* test suggested evidence for the confidence (assertiveness) portion of the combined data. However, while the confidence portion suggested evidence, the stress coping portion of the hypothesis indicated significant strong evidence with  $p < .01$ .

Hypothesis 2 (leadership and communication) was also reviewed in respect to the data. All three competencies for the leadership portion indicated a strong statistical significance for  $p < .01$ . The combined communication portion lacked statistical significance due to the competency of understanding self and others.

Hypothesis 3 (adaptability and management) was also examined. In respect to all the competencies related to adaptability, the combined data suggested strong statistical significance with  $p < .01$ . The combined management portion also had all competencies rating a minimum statistical significance of  $p < .05$ .

The quantitative data given previously in this chapter appear to show that the soft skill hypothesis reviewed did indicate positive statistical change. The findings of this study contribute to the literature regarding PBL's positive affect on various soft skills. The following section presents a summary of the qualitative portion of the mixed design method.



## Qualitative Findings

### Overview

Qualitative assessments were obtained through documents in order to triangulate with quantitative findings. The ability to investigate the quantitative pre- and post-test statistical data, while also reviewing participants' written evidence, makes the research fuller and more comprehensive (Neuman, 2000). Qualitative data were collected throughout the course in the form of a periodic collection of reflections to capture students' reactions. This method followed the document style of collection (Creswell, 2003), a powerful method of obtaining compiled thoughts. This reflection process has been deemed critical to leadership development, and provides the student an opportunity to gain further perspective (Densten & Gray, 2001). Although student reflections were provided throughout the semester, for this study only students' final reflection and portion of a senior exit survey were analyzed per recommended practices (Bresciani et al., 2004).

This method of reviewing the outcome, re-reading the written materials, breaking material into organizational themes, and further checking for secondary themes or patterns, provides a good method for organizing and tracking the qualitative material provided. Since the students were graduating seniors, there was no opportunity to follow up with them after their final written reflections. In lieu of interviewing the students to validate their written reflections, a peer review was used in order to make the information more robust. The final written reflections were good summaries of their earlier written observations, given as the semester progressed. Since the final reflections were volunteered, and in the participants'

own words, they add significant strength to the study and further assist in revealing the respondents' thinking processes, logic, and perspectives of reference (Neumann, 2000).

The final reflections were open-ended since the students were not asked to answer any specific questions, and instead asked to only reflect on what they had learned in the class. At a separate time, the students were asked to submit a senior exit survey. As part of this survey, they were asked two specific, partially closed ended questions used for this research project (as previously described in Chapter 4). This provided an in-depth qualitative response (Babbie, 2001), that through triangulation can substantiate and validate the quantitative findings (Creswell, 2003).

During the review of the qualitative data, there were occasional student reflections that indicated that the student improved in more than one of the skills studied in this research. This suggests that the students grew holistically.

Furthermore, through the use of mixing open-ended and closed-ended questions, the disadvantages of using a question form that may influence the students' qualitative comments can be reduced (Neumann, 2000). The use of qualitative information in conjunction with triangulation has been shown to add a further explanatory role that provides greater validity and reliability (Yeo, 2005).

### **Trustworthiness**

Similar to the process of quantitative data, an important aspect of qualitative research is the concept of validation and reliability. The credibility of the data was confirmed through a combination of four strategies: environment, open-ended reflections, partially closed-ended questions, and peer review. An investigation of the environment was conducted to

determine if the participants believed that the experiment appeared realistic. The combination of open-ended reflections with partially closed-ended reactions enabled the researcher to obtain a better understanding of the emerging themes. The peer review provided an additional level of validity by confirming the themes, and enhancing the accuracy of the account. This process gives the researcher a more in-depth understanding of the qualitative process (Creswell, 2003) and provides additional support for trustworthiness.

### **Review of validity**

It has been argued that the field research environment produces measures with more validity than do laboratory experiments and surveys (Babbie, 2001). Additionally, others (Zolin et al., 2003) have documented that the PBL environment can provide a higher level of realism than a more traditional laboratory experiment. This study investigated this concept through tools such as experimental and mundane realism. Neuman (2000, p. 239) defined experimental realism as when participants are influenced by the experiment, while mundane realism relates to how closely the experiment connects to the real world. This study provides support for validity and realism, through written comments regarding direct impact of the class.

The technique of using both open-ended and closed-ended questions can provide additional insights into the research. An open-ended question provides an opportunity to discover unanticipated findings, encourages creative and potentially rich thinking in the participants' thoughts, and can assist understanding of the respondents' thinking processes (Neuman, 2000). Its format is also superior for responses that may be difficult to effectively anticipate (Schutt, 2001). Since some of the disadvantages of open-ended questions (i.e.,

irrelevant or useless detail, respondent variation, and degrees of thought and effort) can be minimized through the use of partially closed-ended question (Dillman, 2000), the participants are also invited to provide responses to a short questionnaire.

In respect to validity, Bloom (1998) argued that identification with the respondent improves research validity, so rather than jeopardizing the participants' perspectives, the researcher also established additional avenues of review. Once the written comments were compiled, the researcher sent the written comments, less identification, to colleagues who agreed to review, analyze, and comment on the data. This process, peer review, was implemented to prevent omissions, add triangulation and documented observations, and to assist in assuring additional dependability in the study (Merriam, 2000).

In an effort to keep a similar pattern to the procedures in the quantitative section, validity and realism were reviewed, and then the open-ended and partially closed responses that relate to the hypothesis followed. The listing of the hypotheses provides an overview of the responses being reviewed, while allowing written comments to be placed into organized themes. This method was implemented due to the limitations of the written data, and of the process of organizing a mix design methodology.

In order to protect the confidentiality of the participants, per the Iowa State University Institutional Review Board, the qualitative material has been placed in a confidential location. In order to further provide additional anonymity, numbers were used in order to provide identification and reference to participants' comments.

### **Validity and realism**

During the peer review with Dr. Saunders, Iowa State University's Coordinator of Continuous Academic Program Improvement, several student responses were identified who provided additional insight into the questions of validity and realism. According to Neumann (2000), mundane realism is achieved if the experiment resembles the real world, while experimental realism is the impact of interaction and it occurs if the participants are caught up in the participation. This apparent association was noted by several student comments of close connection to the class with realistic or real world experiences. This realization of the class experience was documented in both semesters of the open-ended responses, and by responses to the partially closed questionnaire.

Some students were able to recognize and make specific associations of classroom activities to real-world applications. These comments were often associated with specific activities that a contractor must perform as part of a real company process:

*I enjoyed the real world experiences, sub letter, bidding, and presentations.*  
(#7)

Yet others, although they did not reference specific activities, also recognized that the overall learning experience mimicked real world situations. When describing her/his perspective of the classroom experience, one student responded:

*It simulated a real life work environment working for a commercial type company.* (#38)

Another student, while reflecting back on the overall experience, specifically mentioned the real world aspect of the class:

*Looking back on this semester, I am glad that this class has been made to resemble the real world. I feel more prepared with the experience I have gained.* (#70)

While responding to a portion of the questionnaire (“Do you think the ConE 461 course experience will be beneficial to you in your career?”), a student responded:

*Yes, I think it has better prepared us for real world situations and problems we have run into. This class gives me confidence heading into the real world. (#105A)*

As previously documented in prior PBL articles, although some students acknowledge the realism, they were hesitant during some of the learning process:

*I liked the real world atmosphere of the class, unlike others. You get a better feel for what you will be doing when you graduate. I learn[ed] that in your group you have people that you can depend on and others that you can't always rely on. Some of the little things are kind of corny, but I can see the relationship between them and the class as a whole. (#73)*

There was, however, a predominate theme that the experience, while simulating the real world environment, also provided development and change within students in a holistic manner. Perhaps a fairly representative example of this concept is the following student comment:

*This semester also reinforced the team dynamic, especially with key deadlines. I can't imagine this class taught in any other format. Putting it in the context of “real life” situations is very key for how we develop as persons through this process. (#58)*

In addition to providing reliability and validity to the study, it appears that several of the student's comments recognized and documented the appreciation to apply skills to real-world situations. It further appears that this opportunity also affected other areas of soft skills, as reviewed in the following sections.

**Research investigation**

Final written reflections and subsequent peer review were used to reveal themes and patterns for the two separate semesters studied. This procedure enabled the researcher to provide a clearer understanding of each research question, as they related to each semester and the two semesters combined. This method enables the researcher to further probe the participants' responses in order to gain a better understanding of the respondents (Neumann 2000). Similar to the quantitative section, the qualitative follows the pattern of reviewing confidence and stress coping, leadership and communication skills, and adaptability and management as they relate to changes in the participants. During this process, the research also focused on the question of whether the described changes could be attributed to PBL. The following sections provide the results of this investigation.

**Research 1: Confidence and stress coping skills - Confidence**

For the first part of the research, confidence is better described as an acquired personal attribute. A confident person must be able to voice an opinion in an assertive manner, but without being overly aggressive. In order to learn this characteristic, people typically require experiences to feel more comfortable or confident in their abilities. While prior rote learning processes can provide confidence through successful memorization, it has been argued that this learning method of "filling a vessel" is short term and flawed (Bernold et al., 2007). It has been pointed out that since PBL is an active learning process, an actual behavioral change may occur due to the effect of role playing (Weiner, 1992) and, therefore, more significant long-term learning can be accomplished.

During the review, it became apparent that students did address changes in their confidence level. Although several students gave clear statements regarding confidence:

*This has provided me the confidence that I need as I prepare for the working world. (#1)*

*While challenging, I do feel that I am more competent and confident than ever before. (#44)*

*I think the area that I improved the most was my confidence in my abilities. (#4)*

they did not specifically enumerate in which areas they believed they had progressed.

Other students provided more insight into what kind of confidence-building experiences they acquired. One student specifically described how the learning experience broadened his or her perspective of the entire class through this comment:

*I feel that this class has proved to be a major growth process. Going into the class, I felt that my estimating and scheduling skills were strong. Then we had projects in which the schedule and the estimate had to interact with each other, and I found that I knew less than I thought. I now feel a lot more confident in those skills, and knowing how they tie together. (#34)*

Another student supported that thought process and commented that the experience helped bond the various classes into one complete package:

*I think that throughout the course of the class, I truly found out what it means to be a Con E. Before, I just took the coursework and never really applied it...but I now feel confident heading into the real world. (#48)*

This observation seems to support other articles that indicate that PBL enables students to gain a better global perspective, and leads one to consider that understanding and confidence may be closely tied. It further appears that confidence is slowly gained as the learning opportunities are presented. The following comments suggest that students were allowed to gain from the realism and opportunity to make mistakes. This appears to support



prior thought that a person needs the freedom to experiment in order to strengthen emotional intelligence (Brown, 2004).

*It took me awhile to catch on to everything, but through the progression of projects from the house, warehouse, and the casino, I really feel much more confident in my abilities. (#52)*

*Before this class, I was worried that I would [not] be able to survive in the industry but now, after experiencing a few things and learning from my mistakes, I am very confident that I will succeed on whatever path I take. (#59)*

These reflections indicate that such advancement in the emotional quotient of confidence was allowed by opportunities for realism and progression, and from time to time to learn from mistakes.

Although the students appeared to have an overall increase in confidence, fear of the unknown and public speaking were still in the back of one student's mind while answering the question: "What do you perceive as the biggest challenges that you will face in your career?"

*Confidence in what I know and speaking in front of others are what I perceive as my challenge. I think confidence will come with experience. (#22B)*

It appears however that the student felt that with more opportunities and experiences, her or his confidence level would further increase. This again supports the concept that experience is a critical factor in confidence-building, and gives more credibility to those who support PBL for such opportunities.

Despite the potential apprehension of one student of public speaking, the increase of the confidence attribute may be best summed up by the following students:

*For as much work as it was, I'm amazed that I'm a little disappointed it's over. I enjoyed finding out just how capable we all are when we put our minds to it. (#30)*

*I am much more confident in my professional skills as well as my ability to work in a team. (#69)*

This acknowledgement, while supporting the importance of class capabilities and confidence, provides support to the idea that other competencies (i.e. communication) are also important to overall success. The concept of interpersonal skills in relation to communication will be investigated later in the study.

### **Stress tolerance**

The ability to cope with stress, or stress tolerance, is the second portion of the research topic investigated. Previous authors (Stein & Book, 2000) have pointed to the emotional intelligence relationship between stress tolerance and success. Still others have established a scientific theory that stress can release chemicals (i.e., cortisol) which can block the pathways to logical or higher level thinking (Sprenghler, 1999). This interference would likely cause poor decisions and subsequently inhibits the ability to succeed. As discussed in Chapter 1, since construction can be a very stressful industry, a person's ability to successfully handle stress would increase her or his ability to succeed. Several prior PBL articles (Bernold, 2007; Cano et al., 2006; Prince & Felder, 2006; Ribeiro & Mizukami, 2005; Yeo, 2005) have discussed some positives and negatives that can be associated with student perceptions of PBL-style learning. Several of the authors suggest that the PBL model can affect students in various aspects.

Several of the students acknowledged that the teaching method placed them in situations they had not experienced before. In support of previous PBL articles, one student specifically recognized that this experience created changes from different non-cognitive avenues that they had not practiced:

*It put us in situations that challenged us emotionally, physically and mentally to a point that many of us have never experienced. (#1)*

Another supporting document mentioned the enormous amount of stress that can be related to construction activities:

*The real bidding we did in class was very educational as well. I have never been a part of that process before and I learned an enormous amount about the process and the stress involved. (#2)*

However, another student commented that, although it was educational, it wasn't always pleasant:

*Thanks, I learned a lot even though I didn't enjoy it at times. (#2)*

This broad statement alluding to learning mixed with frustration is similar to other PBL studies (Prince, 2006; Riebeiro & Mizukami, 2005) which, however, do not specifically address the cause.

Other reflections, however, document that a major source of stress is an underdeveloped soft skill, dealing with people. Personal problems were previously mentioned in other articles (Cano et al., 2006) as a major cause of student failure. Although the stress of people problems becomes apparent through a few comments:

*It was very frustrating for me work with such an unproductive group that spends its time complaining and dwelling on the smallest, most ridiculous things. (#39)*

Other students provided a deeper internal reflection, that part of their perceived stress was associated with an inner struggle with the quality of the work:

*Many of the pressures that resulted from this class were self-placed. I know my capabilities, and I never once wanted to turn in anything below my level of capabilities. The stress resulted from the fact I always knew I could do more. (#29)*

Through the opportunity of real world situations, it appears that students were able to gain a different perspective on the tasks at hand, and began to develop broader skills as how to better handle these stressful situations. One student supports this view with this comment:

*I think Con E 461 has been beneficial for me. I have learned how to handle stress in a more positive manner; I have learned that I cannot get along with everyone and not to take things personally (#22A)*

This type of personal advancement became further apparent in the comment of another student. S/he recognized that something initially viewed as negative could change with understanding of its realism, and ultimately become comfortable:

*There were many times that I grew frustrated with the amount of work and the distribution of the work within the group, but I soon learned that this was a possible real life situation and [I realized] how to overcome it. (#72)*

Another student described an initial emotional challenge that transformed into skill-recognition by the end of the course. This student explained that participants now have the capability to handle stressful situations:

*After the class I believe that we are all prepared to work under pressure, work as a team, and are capable of facing anything industry has prepared for us. (#66)*

This realization was also reinforced by another student who stated that s/he achieved personal growth in the capability of handling stress.

In one questionnaire item (“Do you think the Con E 461 course experience will be beneficial to you in your career?”) some participants acknowledged increased abilities:

*It taught me how to deal with stress coming from a different direction. (#99A)*

However, replies to another question (“What do you perceive as the biggest challenges that you will face in your career?”) indicate that successfully managing stress will be an ongoing challenge for some:

*Competition and handling the amount of stress that comes with the job.*  
(#81B)

*Being able to handle stress and problems when things don't go as planned.*  
(#105B)

Overall, the participants provided a common theme that they had experienced changes in confidence, and in the ability to cope with stressful situations. The experience, while perceived as stressful at times, provided a learning opportunity to enhance soft skills. As the class progressed, one student helped summarize the change as definitely related to experiencing the challenge of active learning:

*All in all I feel that the class wasn't actually as hard and I initially assumed. I think most of that were [sic] the horror stories from past classes and the fact that I had a roommate that took this class a year ago. Now that I'm through it I've realized that nothing you asked us to do was above and/or beyond what we are able to do. (#33)*

Another student perhaps summarized it best with the following paragraph:

*Capstone has been the most challenging, stressful, erratic, and demanding class that I've probably ever taken. At the same time, it was the most satisfying and educational of them all. The final presentation probably encompassed all of these sentiments into one. No amount of lecturing can fully prepare you for this event. Having experienced this, I am immensely more confident in my skills than prior. (#74)*

It has been argued that emotional intelligence cannot be obtained in a traditional teaching style of rote learning (Brown, 2004). It appears that the above student agrees with that perspective, as they reference the lecturing method in their reflection. The qualitative comments in this portion of the study appear to provide additional evidence that students exhibit a variety of emotional experiences through this method of delivery. However, while several students indicate a sense of relief at the end of the course, many appreciated the real-life nature of the pressures and constraints as part of their development. Although there were

occasional struggles during this process, it appears to support the idea that the participants experience a change in confidence and stress coping skills.

### **Research 2: Leadership and Communication Skills – Leadership**

Dickmann and Standord-Blair (2002, p. 124) commented that the concept of leadership can be summarized as the ability, and process, to persuade others to achieve a goal. Since this concept alludes to the ability to persuade people, it can be argued that soft skills are an important part of leadership. In fact, prior leadership scholars (Quinn, 2004) have also supported the soft skill concept by indicating that participative and role-transcending are the most powerful leadership styles. Quinn clarified that successful leaders gravitate toward a collaborative and non-hierarchical method of achievement (Quinn, 2004). Effective leaders, therefore, must be willing to avoid micromanaging and incorporate soft skills.

This deviation from a command style of leadership is more challenging according to some experts. However, the notion that leadership administrators must be willing to live with greater risk and legitimacy (Quinn, 2004) closely emulates that of other authors (Gilleard & Gilleard, 2002), who posited that PBL users also need to be pioneers and assume the risk. Following this thought, PBL would balance well with this leadership concept since its strength is associated with an open and ill-defined structure. Ribeiro and Mizukami (2005) conjectured that PBL methodology should positively affect leadership and planning, because they originate in a teamwork atmosphere.

As in the prior category of confidence, participants were able to recognize a change in leadership abilities by directly observing leadership change. One student commented:

*People started to step up and act as leaders in different situations, which was a big step for our class. (#4)*

While some identified a class shift, another student acknowledged that leadership is also an internal change, a quality from within:

*I feel I learned how to be a strong and moral leader. Sometimes I felt like I needed more guidance from you, but I have realized I needed to do it on my own. (#54)*

This realization appears to support the Quinn concept that true leadership growth starts from within an individual.

As in other sections, although these comments helped document the change, they do not provide information of which specific areas or in which ways these changes occurred. Fortunately, some students provided better insight that the leadership development was associated with change in visionary skills and people skills.

One student answered a relevant question (“Do you think the ConE 461 course experience will be beneficial to you in your career?”) as follows:

*I’ve learned how it all comes together in the construction industry. It gives all a sense of the bigger picture. (#15A)*

However, not all students indicated team-level success in the process of developing these essential skills. Although they allude that they had visionary capabilities, they also state that other colleagues were challenged to find the overall objective. They acknowledged their internal struggle in leadership, and therefore shifted their efforts toward the organizational and management competency:

*I would like to say that I learned how to be organized and how to motivate people, but by looking at our group performance I can easily see that I still need a lot of work in that area. I personally think I became better at time management as the semester went on. (#33)*

It appears that several students also recognized initial challenges with balancing peoples' perspectives, along with the more advanced concepts of trust and subsequent delegation in order to obtain the overall goal. This challenge and then subsequent growth in the leadership side is documented by one student:

*The non-technical side was a tougher battle. I feel that as a team of seven different people with different views and opinions, that our biggest lesson was how to deal with people. I had the "privilege" of taking part in managing a project and managing the people in it. As a team we were challenged with different opinions of what was important and what was not. I feel as a team we were able to overcome those challenges effectively in the end. (#49)*

This advancement was also voiced by another student who commented that s/he had grown internally as a leader. Specifically, several students mentioned the concept of gaining trust. The concept of first developing trust relates to a prior study (Zolin, et al., 2003) that argued that PBL would allow students to grow in this area. One student's comment appears to directly follow this thought process:

*As it pertains to leadership, I quickly learned that I find it hard to trust my peers to get things done. Because of that lack of trust, I found myself micromanaging and always trying to get the details of what everyone in my group was doing. As the semester progressed though, I learned that my teammates were more than capable of carrying out functions without people constantly checking on them. (#34)*

However, the issue of developing better visionary skills and trust still appeared to be a challenge for some groups. A previous article by Yeo (2005) revealed that PBL can create an environment in which some students and teachers can actually become frustrated with the change from rote learning. One student acknowledged this frustration with the following observation:

*However, these team members are not able to look at the large picture, they were only able to focus on times that people were out of the office. This*



*became extremely frustrating for me as I continually warned my team of just how much work we had to complete. (#39)*

Perhaps the most insightful comment is from one student who points out that everyone has an opportunity to become a leader in his or her own way. This holistic viewpoint is expressed here:

*I found out that I can be a leader and that when people look at you as one you have to act accordingly. I had a really tough time delegating responsibility and that initially caused some problems. After I realized this I began to delegate more effectively and our group never stopped flowing. This is not to say I was the only leader. I learned that everyone leads in their own way. Though they may not be as vocal as I was, when we worked in teams of two or three every one stepped up and it was here I learned that people sometimes just need to be put into a position of leadership before they assert themselves as one. (#50)*

Authors have stated that leadership should be a critical part of the engineering education process (Walesh, 1999). Although it is an important skill, a study by Davies et al. (1999) revealed academic failure in teaching leadership abilities. In order to be effective, however, leadership should be in balance with the soft skill portion, as previously mentioned in Chapter 3. If a leader does not also show a caring and sympathetic side, s/he is at risk of becoming unreceptive and disconnected from the team (Quinn et al., 2003). These qualitative comments appear to support the concept that leadership can be learned through PBL (Ribeiro and Mizukami, 2005). However, the comments also acknowledge the importance of soft skills in successfully accomplishing this task (Quinn et al., 2003).

### **Communication**

As discussed in the first chapter, communication has been a major soft skill topic. This soft skill concern has been a common theme for researchers (Russell, 2003; Thamhain, 1992), the construction industry (Klinger, 1956), consultants, and numerous academic and

organizational agencies and their publications (ASCE, BOK, Policy 465). This concern has, in fact, been so critical that some researchers (e.g., Gilleard & Gilleard, 2002; Thomas et al., 1998) have provided articles that specifically focus on this soft skill.

The need of this skill appears to be critical to the overall success of engineers. In one survey, 60% of employers said new engineers are not adequately prepared (Bishop, 1996), and some have suggested that lack of communication skills is the main problem area for engineers (Walesh, 1999). Thomas et al. (1998) noted that, although managers typically relate communication to project success, little advancement has been actually achieved in this category.

Chapter 3 discussed the idea that a balance in leadership and communication is desired in order to be successful. Working with people, whether in teams or individually, is a critical function in any organization. Recall that while others have discussed challenges in effective communication (Yeo, 2005), other researchers (Brown, 2004; Prince & Felder 2006; Ribeiro & Mizukami, 2005) have theorized that PBL is a method that will assist communication. A further study by Gushgari et al. (1997) revealed that college courses were the least-ranked method of effective training for project managers and principles. The study further ranked items more associated with PBL (such as working with a mentor, and personal study) as the highest ranking results for effective training.

As experienced in patterns with other prior categories, several students recognized changes with their interpersonal skills and communication ability. Numerous students provided such a statement in their reflection portions:

*Overall, I do think this class was a great learning experience and greatly improved my communication skills as a whole. (#9)*

*My communication and team skills were strengthened. (#12)*

*I became a better communicator and I strengthened my critical thinking skills (#4)*

*Yes, I think a lot of my skills were strengthened in this class, such as communication, and teamwork. (#21A)*

These observations further coincided with additional student responses in the questionnaire portion. Responses to one question (“Do you think the Con E 461 course experience will be beneficial to you in your career?”) included:

*Yes. The most important thing I learned was communicating with a large team. (#81A)*

*Yes, it was beneficial. Above all also I learned communication skills and the discipline to get things done (#98A)*

However, despite the number of acknowledgements, students did not necessarily specify in which areas of communication they observed improvement.

However, some students were more specific and added valuable insight:

*This class was a huge learning experience for me. It taught me a lot about people and how unlimited my capabilities are in the work environment. The most challenging part of the class for me was working with my group. (#38)*

Another student mentioned his/her overall change in learning to communicate with others through the technique of empathizing with another’s position:

*As I reflect on the semester, I believe I have changed in two ways. The first way is the way I read people and understand where they are coming from. In other words my empathy level has gone up. The second transformation is management. (#51)*

This idea was echoed by a subsequent student written comment:

*I think the class has helped give me an appreciation for what other people do in our industry (architect, structural, MEP). I saw it all come together. I also saw where my weaknesses were. I think knowing them is a benefit to me so I*

*can work on them. I feel I have many strong skills, and this class helped to further develop them. (#54)*

These comments apparently support the concept of others (Quinn et al 2003, Stein & Book, 2003) that interpersonal skills are key for developing strength in other competencies, such as leadership.

Again, this thought surfaced in the questionnaire portion (“Do you think the Con E 461 course experience will be beneficial to you in your career?”) in the following replies:

*Have learned team skills, different viewpoints, to look at things, how people think. (#94A)*

*People have their own ideas and methods which may or may not align with mine. This was a struggle, but you begin understanding personalities and people. (#19A)*

*I learned the most about the function of a team in the construction industry. I learned a lot about other perspectives of the different “players” in our industry as well. (#87A)*

It appears that realization of interaction with others was a major theme in several student comments. Another student referred to the sometime delicate technique of working with people to gain the necessary motivation to succeed. This realization of the importance of interpersonal skills appears in this comment:

*There were a lot of things I learned this semester that I could have never imagined I would [sic]. Such as my ability to work in a group; yeah, in other classes you do get to work in groups but here it is a lot more intense. You need to have everyone fully contributing because otherwise you will never get anything completed. One other thing I learned was that everyone has different techniques of motivation and you need to respect those techniques or you are just going to be fighting with each other the whole time. (#31)*

However, similar to the comments of some (Prince and Felder 2006), and to the observations of others (Yeo, 2005), some participants had a difficult time dealing with the people side of the equation:

*I feel I really improved my people skills, but it was very difficult at times.*  
(#45)

Another student put it more insightfully:

*This has hopefully been a good leaning experience for my group and I really do hope that these members will be able to see the good aspects of teamwork instead of constantly dwelling on the smallest negative things that actually do not matter. I know that I did snap at them a few times for this which was not right on my part and I was able to learn a lot about my issues with teamwork also. I think it is interesting how a few people's negativity has such an impact on a team.* (#39)

This constant dealing with the difficult aspects of people appears to be an ongoing theme. Despite the people challenges that some groups faced, the learning environment may also have helped students recognize potential future challenges within their careers:

*This class allowed me to take on a lot more responsibility which I enjoyed, but occasionally loathed. You really learn what teamwork is all about when you have to count on six other people to pull their weight; and what happens when they decide not to [sic]. In talking with people already working though, I will probably be dealing with that on most jobs in most cities. The big dilemma is how to deal with that, can you get that person on board or maybe they need to be fired. The frustrating part is how much that started to overshadow the semester with dealing with that type of behavior.* (#43)

This comment confirms the people and teamwork issues that some groups encountered. However, the realization that dealing with people is a real life, long-term issue appears instrumental in acknowledging reality and benefiting from this learning opportunity.

During the qualitative review, another theme that was apparent was the realization of the trust, personal, or humanistic side of successfully working and leading teams. Per a prior research article (Zolin et al., 2003), the interpersonal soft skill of trust was deemed important

to success during the case investigation into PBL. Another case study (Yeo, 2005) stated that students sometimes have an issue with trust, and the interpersonal skills associated with delegation in PBL. It was stated that the success of PBL includes enhancement to interpersonal skills, such as trust and confidence. The apparent development of trust, and subsequent delegation and people skills, can be visualized with some of the comments. Two examples relate to the following comments:

*I had a really tough time delegating responsibility and that initially caused some problems. After I realized this I began to delegate more effectively and our group never stopped flowing. (#50)*

*I learned how to delegate tasks and to trust that they will get done, without [having] to harp on people to get them done. I think I learned more people skills than anything else all semester. (#46)*

This development of trust appears to have lead to better understanding of people, and thus also assisted in the development of communication. This growth also appears to have come with time and experience:

*I quickly learned that I find it hard to trust my peers to get things done. Because of that lack of trust, I found myself micro-managing and always trying to get the details of what everyone in my group was doing. As the semester progressed though, I learned that my teammates were more than capable of carrying out functions without people constantly checking on them. (#34)*

Another interesting development that appears during this process of group interactions is when some of the students perceive, through reflection, changes in their awareness of themselves and others. This transition appears to be understood in some of the following student comments:

*Overall, I feel that I learned the most about myself and how to become a better team player (#4)*

*I've learned a lot about myself and others in my group. (#35)*

*Capstone has taught me a lot about myself. (#41)*

A leadership researcher, Quinn (2004) argued that a leader must be more internally directed and people focused, yet open minded to external needs. In addition, per other researchers (Densten & Gray, 2001), this ability to reflectively learn is related to the direct core of leadership development.

Although the students appeared to recognize the increase in their communicative and associated leadership abilities, some realized that dealing with people will be a lifelong challenge. Despite the apparent enhancements in communication, some students still agreed with several prior authors who identified the future importance of communication. This can be seen in some of the comments in respect to this question: “What do you perceive as the biggest challenges that you will face in your career?”

*Communication with others. (#75B)*

*Communication, dealing with different people (own company, subs, suppliers, etc.) (#83B)*

Another student, while citing this potential future challenge, commented:

*Dealing with people. I feel I have the skills required and I can learn new things quickly. As mentioned before, Capstone has helped develop my people skills. (#108B)*

In this case, the concern is qualified by the student’s comment that s/he has already experienced growth in the area. The concept of growth is further expanded by another student:

*I know I have personally grown as a person by going through Capstone. (#69)*

Another who appeared to recognize his/her lifelong learning opportunities:

*I would also be grateful that you put yourself through this every semester as I know that the personal growth, understanding, and professional knowledge I have gained will forever be invaluable to me (#41).*

Although it has been stated that several items such as problem-solving and life-long learning are difficult to measure (Prince, 2004), these types of comments appear to support other researchers who theorize that PBL may be able to provide a learning experience that helps participants become lifelong learners (Ribeiro & Mizukami, 2005).

Although prior writers have questioned if leadership and communication can be taught (Roesset & Yao, 2002) due to the difficulty of academic settings, others (Yeo, 2005, Prince & Felder, 2006, and Ribeiro, & Mizukami, 2005) have argued that PBL might be able to make the transition. One student arguably summarized the development of several competencies (including leadership) as follows:

*I don't know how you came up with this concept for the class, but it is definitely working. I have sensed a transformation in leadership, confidence level, and overall pride in the major. (#19C)*

This acknowledgement seems to add more support to the view that PBL can be an avenue for such advancement.

It has been referenced previously in this study that communication skills closely relate to leadership development and overall success. The qualitative comments in this portion of the study appear to provide evidence of improved people skills, communication, and subsequent leadership. It appears that, through these newly acquired skills, students were able to establish and gain trust, build relationships, and develop their leadership skills. As indicated in prior sections, although there were struggles during this process, the comments appear to support the idea that students encountered a change in leadership and communication skills.



### **Research 3: Adaptability and Management Skills – Adaptability**

As discussed in Chapter 3, a balance is needed in order to achieve success in several behavior skills. Prior associations have been cited between success and a person's ability to be adaptable or flexible. According to a 2006 study (Coll & Zegwaard, 2006), recent graduates determined that the biggest required future changes in behavioral ranking would be flexibility and written communication. This was also reinforced by faculty views in which the most notable change in rankings were in flexibility and technical expertise. The study indicated that more of the behavior skill sets would be important to recent graduates entering the workforce. It was also noted that people will require a mix of flexibility, achievement goals, and adaptability early in their careers.

A study by Davies et al. (1999) further indicated that recent graduates viewed the important skill sets of adaptability and flexibility as receiving low attention in their academic experience. Wellington et al. (2002) argued that current students are unable to properly cope with ambiguity and are unable to handle people from different backgrounds or perspectives. This lack of adaptability can also adversely affect communication and teamwork skills, as it relates to the global and societal context of contemporary issues.

The concept of being adaptable also fits into normal conflict management situations. The collaborative approach is based on creatively addressing the problems, and adapting the goals, of others in order to create a win-win solution (Quinn et al., 2003). This concept is further supported by behavioral research which indicates that people who lack flexibility with new ideas and thoughts are incapable of properly adapting (Stein & Book, 2000).

A leader needs to be adaptable and flexible. With his coined description *adaptive confidence*, (Quinn, 2004, p. 151) Quinn argued that people need the skill of entering

uncertain conditions with the belief and confidence that they will learn and adapt as the project moves forward. His premise is that successful leaders realize that most learning is found through initiative, creativity, and adaptation to the changing environment. This concept is similar to PBL research (Prince & Felder, 2006), which theorized that an open-ended and ill-defined problem encourages development of meta-cognitive skills. The awareness of knowledge and the adaptability of the experience enable development in cognitive and behavioral skills. Since PBL utilizes ill-defined solutions and structure, it may also encourage a change in the participants' adaptability skills.

Adaptability is the ability to successfully adapt to changing, unknown, or random situations. In order to perform this function effectively, a person should be able to recognize and handle ill-structured or unpredictable situations in a positive manner. One student appeared to recognize this skill enhancement:

*Learning how to apply my engineering base knowledge to new topics and other areas of study, being able to adapt to new environments and pressures, seeing how everything I have learned in the last few years ties together, and refreshing all those classes I took during my first couple years are all positives I feel like I have walked away from the class with. (#64)*

This direct recognition of being able to adapt to new environments and pressures was similar to another student, who explained that the class increased his/her ability to handle different situations:

*Not only did the course further my knowledge of construction and its processes, but it also taught me how to handle situations that may arise in a real life bid or building situation. (#72)*

Another student, while not using the word "adapting" directly, alluded to the concept by indicating that during the class s/he was able to recognize the group challenges, and

successfully modify the conditions. This concept of recognition and flexibility is described here:

*Even more than the class was the group bonding, I definitely found the things I liked and disliked from my group members very quickly. With that being said I learned to work with the group members to take advantage of their good qualities while working around the disadvantages. (#8)*

Another student identified that as the class progressed, people found methods of interacting that developed a better working condition:

*It has also been a challenge to improve communication skills not only in our own groups, but also for the entire class. In the end we all found ways to work together and achieve the tasks that we were assigned. (#11)*

In addition, during the ill-defined process, the ability to be creative and innovative (Quinn, 2004) appeared:

*I enjoyed being able to be creative yet still have some form of constraint. (#54)*

*It's nice to be able to use our creative ways and thinking without someone saying "this is the way it is to be." (#65)*

Another student speculated that the class intentionally provided unpredictable activities in order to facilitate transitions into stronger adaptability behavioral skills, as the class was acquainted with new ill-structured activities. The use of ill-structured activities provides the opportunity for growth in adaptability as students become acquainted with resolving these types of issue:

*I think at times there were acts or assignments put in place to help each class individual deal with new stresses. (#3)*

Through these types of functions, it appears that student's recognized enhancement in their skills:

*I have the talents to think on my feet and react to situations, now I can apply it to my job. (#4)*

The ability to quickly think and react to jobsite situations is a valued skill desired for effective project leaders in the construction industry (Odusami 2002).

Another student recognized that the class environment provided students with an ability to learn from their prior failures:

*I am also happy I stumbled in this class. I have learned where many commonly fail. If I ever pass by these pitfalls again, I will be prepared to avoid them. (#29)*

This example of an in-class learning experience was not the only time this opportunity was mentioned. Perhaps another student summarized it best in the following short observation:

*Although the work we were expected to do was in some cases time-consuming, as well as a lot of things needed to be handled and taken care of at one time, I feel this was the best class in showing to ourselves that we are able to handle whatever is thrown at us, as well as the fact that we have the capabilities to handle it all. (#28)*

The qualitative comments in this section appeared to mean that students acknowledge that the class had a direct affect in their learning how to interact, adapt, and resolve ill-structured problems. Although this capability has been previously acknowledged as a desired skill, it has also been noted that this capability should be balanced with management skills. The next section investigates this portion of the successful competency.

### **Management**

Quinn (2004) argued that a strong management role, although an important part of our system, can fail to lead a firm into new territory if a person lacks the skill of adaptability. However, as revealed in Chapter 3, it is also acknowledged that management functions are

another essential portion of success. In essence, a person should envision and be adaptable to change, and yet be able to maintain a level of management structure.

It has been argued, however, that these types of skills are not learnable in an academic setting. In fact, some people go so far as to argue that certain sets of skills like management, ethics, bid preparations, and communication could not be learned in the classroom and can only be learned in a professional world (Bishop, 1996). However, another study indicated that students believed that, with sufficient time, PBL could assist in several areas such as the management portion of planning (Ribeiro & Mizukami, 2005). This idea appears to support another—that real-life projects could assist students in management techniques (Cano et al., 2006) much more effectively than lectures.

Quinn. (2005) presented the position that, if self-managed or cross-functional, work teams have more control on how work is managed or organized. Workers will consequently identify the work as more interesting and motivating (Quinn et al., 2003). This scenario appears to fit the PBL style of increased interaction with ill-structured problems. The latitude and opportunity of an unaccustomed level of responsibility arguably changes management and team atmospheres (Prince & Felder, 2006). However, similar to Quinn's (2004) perspective, it has been argued that PBL's allowance of options also provides a more challenging, enjoyable, and motivated educational environment (Prince, 2004).

As students had done in prior categories, some directly recognized and acknowledged changes in their management abilities such as coordinating. Such a student view can be seen in this reflective comment:

*The second transformation is management. I took on a role on the MU job and did a pretty good job coordinating and delegating the materials. (#51)*

However, as in the past, this type of comment did not well-define how that knowledge was obtained. This was further substantiated from subsequent insight as the students responded to this question: “Do you think the Con E 461 course experience will be beneficial to you in your career?” Several students clarified further that they had grown in management techniques such as organization, time management, multi-tasking, and realizing the true value of teamwork:

*I learned how to work in a group, how to manage several tasks at once, and how to put all my skills and classes together to create our final design/build. (#79A)*

*Yes. I learned a lot about working closely with a team and managing problems with it. I also learned a lot about time management. (#108A)*

*Yes, how to prioritize tasks when multiple things hit at once (#23A)*

*Yes—organizational skills. (#82A)*

*Absolutely, time management, multitasking and delegation are all important to succeeding in a career (#84A)*

While some students acknowledged their managerial development, it appeared that some also perceived failure a need to improve in the future:

*I would like to say that I learned how to be organized and how to motivate people, but by looking at our group performance I can easily see that I still need a lot of work in that area. I personally think I became better at time management as the semester went on. (#33)*

This comment is interesting because the student recognized the unique relationship between management, and the need to improve people skills. Even though it appears that the students were initially discouraged with its results, they had realized a need to improve in this area in the future. This close relationship between management and people, again, follows the necessary association of skills that others have addressed (Quinn 2004, Stein & Book,

2000). Another comment recognizing the association of people's involvement with success appeared to imply that learning from failure is just as important to the overall success of the project:

*You really learn what teamwork is all about when you have to count on 6 other people to pull their weight; and what happens when they decide not to. (#43)*

This type of written reflection correlated with another prior study that indicated that trust was an important part of success (Zolin et al., 2003). According to one student comment:

*Managing people is a large part of what ConE's [sic] have to do. Capstone started to get us ready for this with the team projects. Every team had someone that was not pulling their own weight. Capstone gave us a taste of some of the things that can occur in a team project, and just dealing with people. Capstone has showed me some techniques that work better than the ones I was using. (#55)*

It appears that the course enabled students to experiment with various techniques and methods which in the end assisted them in team projects. With these opportunities and time, students developed their level of skills:

*I can't believe how our group improved over the semester. Every task got easier and took less time than it did during the warehouse project. (#46)*

This provides an example of how one student believes her/his group improved as time continued in the class. It further appeared that the class as a whole had a learning teamwork opportunity:

*I learned a lot during Capstone. I learned how to deal with my company and my classmates. I think everyone learned how to work as a team. (#46)*

*Towards the end of the class, I was amazed at how well everything came together. (#48)*

Another comment indicates that students are aware that these types of skills will be advantageous to their future experiences:

*All of these types of things are going to be expected of us after graduation, and it gave me a great feel for how to handle things, and make sure what needs to be done most importantly is done on time. (#28)*

The aforementioned acknowledgements contrast with a prior study (Davies et al., 1999) in which students, in a normal academic learning environment, stated that they were not properly prepared for immediate workplace skills. These results generally replicate previous studies indicating students' acknowledgement of the need for more group work to develop greater teamwork, leadership, and interpersonal skills (Coll & Zegwaard, 2006). It appears that PBL is a method which has assisted the management and interpersonal adaptability skill of the students.

### **PBL effect**

Last, although throughout the review of the prior qualitative material, it appeared that several students acknowledged changes relating to the class, the researcher was able to provide additional comments that appear to provide additional support for the influence of PBL. One participant acknowledged this change as follows:

*I learned more this semester than I have in all my semesters put together. (#46)*

Others affirmed the critical importance of this type of class:

*I think Capstone is a very valuable tool in the Con E program. I don't believe that graduating seniors would be nearly as prepared for the real world without going through this experience. (#69)*

*I can't imagine this class taught in any other format. Putting it in the context of "real life" situations is very key for how we develop as persons through*



*this process. It is like no other class and needs to be to allow us to put all the pieces of our education together. (#58)*

*I really don't think that there is a better way to run this class. There are probably some small things here and there that could be adjusted, but the class as a whole is very successful. (#56)*

And other provided these two intriguing perspectives:

*I saw the class as more of a life management class tailored to the construction engineer. (#3)*

*People are scared of pain. Capstone can be painful, but it is the best thing for graduates. (#99C)*

Although these commentators do not significantly detail their thoughts, another participant provided more insight:

*Without a doubt, this class creates the largest sense of comradery of any other class at Iowa State. In much the same way as the academy functions, a stressful environment creates unity. Along with learning so much in this class, we have all created lasting relationships that will keep our ConE program strong. Without this class, I truly believe alumni would fade into obscurity. (#29)*

As further interest, some participants appeared to gain knowledge from their experiences and went so far as to claim that they obtained life-long learning skills that will assist them later in their careers:

*Overall I would say that I learned more in this class then I have in the four years here. Maybe because for the first time I used every skill I have taught, but I think the bigger thing was that we used these skills and applied them to real world situations. In conclusion I wouldn't change a thing about this class. The lessons taken from this semester will with out a doubt stay with me throughout my career. (#50)*

*The reality here is this; this class could be four years long as opposed to 16 weeks and there would still be "more" to cover!! I now feel that the tasks that we were covering were very important. And though I never became a "pro" in every subject, [that] does not mean that the experience will not be invaluable to me at a later date. I enjoyed this class and would not change a thing. (#49)*

These statements appear to support prior authors (Ribeiro & Mizukami, 2005), who theorized that PBL can provide a learning experience to assist in life long learning.

However, perhaps the strongest direct PBL support came from a student who provided a clear frame of reference to his/her educational experience:

*Problem based learning was a great tactic and was very affective. I knew I was an extrovert, so this style of teaching was great for me. Regurgitating material that has been spoon-fed is easy, it depends on how hard you wish to memorize and pretty much plagiarize. The challenge is fun. All classes should be taught like this.*

*Overall Capstone has made the Con E program for me. All the other classes were the nuts and bolts. Capstone gave us the wrench to tighten. It was a blast and I will remember all the life lessons and implement these when applicable.*  
(#51)

## **Summary**

This chapter reviewed qualitative findings through analysis of the written comments and answers to the questionnaire for two separate semesters of Capstone students. When presented together, it appears that the participants experienced an improvement in confidence and stress coping, leadership and communication, and adaptability and management soft skills.

When these competencies were further investigated, it also appeared that the aforementioned soft skills were positively enhanced through comment examples provided by the participants. In fact, students grew in both ways along the pairs of items (e.g., confidence/stress coping, leadership/communication, adaptability /management) that have been previously presented as necessary to assure a successful balance (Chapter 3). It appears

that not only did the participants appreciate the soft skills they developed; they further understood the bottom line on how these skills directly related to their profession.

Per prior references in this study, several authors have argued that PBL can provide a method of change for various soft skills. As demonstrated by the qualitative comments, it appears that PBL has been a bridge to develop confidence, stress coping, leadership, communication, adaptability, and management skills. In other words, not only did students recognize their skill development, but they also recognized how it gave them direct strength in many aspects of their profession.

## CHAPTER 6: DISCUSSION

Academic accreditation agencies such as ABET, professional consultants, academic researchers, and the construction industry have noted the need to improve the education of future professionals to include soft skills. Although previous studies have suggested that PBL methods are effective in teaching soft skills, these studies did not investigate the relationship between PBL and key soft skill competencies. The current study investigated the relationship between PBL and the learning of soft skills.

This research provides two findings: (1) non-cognitive competencies can be improved through PBL in a classroom setting; and (2) PBL methods appear to be associated with these changes. It was not the intent of this research to suggest that long term behavioral changes were documented. Non-cognitive skills improved but, since this study was limited to two semesters, these improvements may or may not be indicative of long-term behavioral changes by the participants.

This chapter provides a summary of this research study, and is organized into three sections: (a) summary of the study; (b) analysis and discussion of the findings; and (c) implications for practice.

### Summary of the Study

Chapter 1 described the importance of the need for soft skills as a critical part of a person's success in the construction industry. This chapter provided an overview of various items that limit a successful project. People skills were identified as a major influence. Despite the breadth of research in construction, there are very few studies that address the impact of personal soft skills. This study was conducted to help inform the construction

community whether these non-cognitive skills could be taught in an academic setting. More specifically, this study attempted to determine the PBL methodology can be applied to achieve this necessary improvement.

The literature review in Chapter 2 indicated the importance of soft skills to the construction industry. It recognized three different vested parties: professional consultants, academia, and the construction industry. Reviewing these respective perspectives provided a basis for understanding the need for enhancement in the soft skills.

This summary of related literature included: survey results of skills from professional consultants (Hessen, 2000, Schoppman, 2006, Wilson, 2007), academic pursuit of improvements (ABET; Roesett & Yao 2002, Russell 2003, 2004; Shuman et al., 2005; Sinha et al., 2002), and construction concerns (Bernold, 2007; Cano et al., 2006; Davies et al., 1999; Guishagari et al., 1997; Klinger 1956, Odusami, 2002; Russell & Yao, 1996; Thomas et al., 1998). Following the review of the literature, the researcher presented two assessment tools (EQi and CVSS) that appeared to appropriate measures to provide quantitative data for the purposes of this study.

Chapter 3 presented the research questions and hypotheses proposed for this study. Prior researchers (Cohen, 1987; Coll & Zegwaard, 2006; McGraw, 2004) were referenced to formulate the research questions and hypotheses in an effort to lay the groundwork for studying the effects of PBL. For the purpose of investigation, there are three sets of competencies: confidence and stress coping, leadership and communication, and adaptability and management skills. As Chapter 3 described these competencies, it also clarified the importance of the associations and the need for balances between these competencies.

Chapter 4 described the potential challenges with human subject research and justification for the use of a mixed design method in this study. The mixed design method (Creswell, 2003) provided a method in which quantitative data can be used in conjunction with the qualitative data. Additional information of the participants, and further descriptions of the two assessment tools, provided the basis for further understanding the quantitative data.

Finally, Chapter 5 presented the results of the quantitative and qualitative analyses. The quantitative portions of the assessments were provided and the qualitative open-ended questions and questionnaire provided additionally rich themes and patterns, and further insights into the participants of the study. The qualitative analysis was provided in the same order of the pattern established in the prior quantitative portion.

### **Analysis and Discussion Overview**

This part of the study focused mainly on investigating if changes occurred in non-cognitive skills. The research was conducted to determine if PBL could improve undergraduate students' soft skills through pedagogical and curriculum design changes. In order to address this question, various competencies of students were measured at the beginning and end of two separate semesters. The study revealed that students from both semesters experienced improvement in several non-cognitive skills by the end of the semester.

The mean difference for all subcategories investigated indicated an improvement from the pre-test to the post-test, excluding one subcategory (understanding self and others) which decreased slightly for S06 only. This negative change for S06 was minor (0.073)

versus the improvement in other subcategories, such as the high of stress tolerance (3.541) for that semester. This slight deviation is not overly surprising as several authors (Dickmann & Stanford-Blair, 2002; Quinn, 2004, Stein & Book 2000,) have argued that the ability to recognize one's feelings, and the feelings of others, are skills that are typically developed later through life experiences.

The qualitative portion of the study further supported and provided additional insight to the logic, thinking process, and specific references made by the participants. Subsequent to the qualitative review, the self-expression enables further insight regarding answers to complex issues. This mixed design process provided additional richness of detail and allowed for the investigation of additional, more in-depth information on the acquisition of soft skills.

### **Confidence and stress coping**

Since the observation of confidence and stress coping skills has been identified in the EQi's practitioner's handbook, the association appears very relevant to this study. As previously mentioned in Chapter 3, lack of stress coping skills can lead to poor decisions and subsequent erosion in confidence. PBL has been previously identified as a learning method that may affect stress in a variety of ways.

Reviewing the combined quantitative data for confidence and the ability to cope under stress reveals suggestive evidence for the confidence portion. Although the quantitative data indicate suggestive evidence for the confidence or assertiveness portion, the qualitative data provide the additional supporting evidence that the participants did experience a positive change. Through the participants' written reflections, students were able to acknowledge their growth of confidence and directly relate it to the class. This

realization further supported the previously argued theory that a PBL process, a method of active learning, could enhance non-cognitive behavior skills (Weiner, 1992).

Since the students attested that they literally observed themselves gain in their abilities, they supported the argument (Brown, 2004) that the freedom to experiment that PBL provides assists in the development of soft skills. Even students, who initially acknowledged some need for improvement, also realized the importance of the process and the need for their development, and conjectured that it was an item that they could improve over time. This realization, and the plan to improve, follows an important stage in a person's future growth (Bar-on 2005; Quinn, 2004, Stein & Book 2000).

The quantitative results for the ability to cope under stress indicated significant evidence for positive change. Again, the qualitative data of the mix design provided further insight and support for this observed improvement. While several qualitative comments addressed the time commitment, workload, team interactions and management aspects that contributed stress, as the end of the semester approached, several students observed and appreciated the real life nature of the constraints and pressures that they experienced.

Although some acknowledged challenges while dealing with the personal and professional balance, most recognized that the major portion of their stress dealt with dealing with people. This observation provides additional support for other PBL authors (e.g., Cano et al., 2006) who indicated that interpersonal problems were a major cause of team failure. However, the real world situation, and the opportunity to experiment with a variety of techniques, again, helped the participants to realize and express verbally how this experience helped them improve by the end of the class. Not only did some students realize their own



personal growth in this area, but they also acknowledged that this was an item that they would have to contend with in their future careers.

Overall, the participants not only recognized their improvement in confidence and stress coping skills, but they also realized that this class helped influence their improvement in these soft skills. Through these observations, this study provided data which further supports finding by other researchers (Brown, 2004; Prince & Felder, 2006), and indicate that PBL is a method that can enhance the soft skills of confidence and stress coping.

### **Leadership and communication**

Some leadership scholars (e.g., Quinn, 2004) have associated good leadership with good communication. Similar to other authors (Stein & Book, 2000), Quinn's theory argued that a good leader should also be flexible, open, and receptive to the feeling of others. As described in Chapter 3, the balance between vision and people skills is a necessary part of leader effectiveness and an organization's success. The interactions of these soft skills are apparent since a good leader is typically defined as a person who can understand and communicate with others to achieve a goal (Dickmann & Stanford-Blair, 2002). Again, since PBL is a method of interaction in an ill-structured experimental environment, participants should be presented with the opportunity for change.

Investigation into the leadership portion of the combined data appears to provide evidence that a positive change occurred. This support is significant as a common pattern ( $p < 0.05$ ) is apparent through both semesters, and all subcategories, for the quantitative tool utilized. In addition, the quantitative data were further supported by the qualitative data provided in the open-ended and partially closed questionnaire. Throughout the review of the

qualitative responses, participants specifically mentioned changes in themselves and also observed change in others as the class progressed.

It appears that these leadership changes occurred over time and were directly related to the class. As described in the qualitative responses, some participants mentioned the interpersonal challenges, their experimentation in approach along the way, and the subsequent interpersonal growth as they began to understand the delicate balance between leadership and communication. This realization might be best viewed as some students became aware of the value of trust. As indicated in some of the qualitative data, participants acknowledged that their initial tendency to trust the work of others was difficult. However, as the class progressed, they also realized that this lack of trust was adversely affecting their ability to effectively lead. This observation appears to provide additional support to a prior PBL study (Zolin et al., 2003) that specifically focused on the interpersonal relationship of trust. According to the Zolin study, the argument was made that PBL allowed students to grow in this soft skill competency.

The soft skill of communication, addressed in Chapters 1 and 5, is of major interest for research, the construction industry, consultants, and numerous academic pursuits. Although much has been written about the importance of communication, several researchers have also provided evidence that academia is currently failing in the area (Bishop, 1996; Thomas, 1998; Walesh, 1996). While the challenges of learning communication in an academic setting have been well-documented (Yeo, 2005), other researchers (Brown, 2004; Prince & Felder, 2006; Ribeiro, & Mizukami, 2005) have argued that PBL is a method that will enhance growth in communication development.

In respect to communication skills, the combined quantitative data and qualitative responses appear to provide support that the humanistic side of communication can be gained through PBL. The combined quantitative portion of the data provides strong evidence ( $p < 0.05$ ) that there was strong development of participants regarding individual development, empowerment opportunities, and empathetic techniques of listening and showing caring and sensitivity toward others.

The qualitative responses provide additional robustness to the study in regards to communication enhancement. Although some students indicated an initial struggle with people skills, several participants mentioned that, with time, they developed better communication and interpersonal skills within their respective group and overall classmates. This observation appears similar to the leadership comments that indicated that this skill improved.

Again, similar to leadership, some students acknowledged the challenges that they experienced, but later noted they perceived that they improved in the communication category as the class progressed. Others, contrary to the initial quantitative data, even mentioned being able to better “read” people, appreciate their perspective, and understand where they are coming from (i.e., their input to solve a challenging problem). This ability to understand self and others appears to be unusual, since several authors (Bar-On, 2005; Quinn, 2004; Stein & Book, 2000) argued that this type of skill is typically learned later in life. However, it does support other leadership theories (Densten & Gray, 2001; Quinn, 2004) which state that internal reflection assists in the development of leadership skills.

Similar to the confidence and stress coping category, it also appears that the students recognized their improvement in leadership and communication skills as the class

progressed. This study appears to support prior authors (Prince & Felder, 2006; Ribeiro & Mizukami, 2005; Yeo, 2005) who conjecture that soft skills, such as leadership and communication, can be learned through PBL.

### **Adaptability and management**

The ability to envision creative solutions and reliably implement them requires a delicate balance. However, as described in Chapter 3, the ability to adapt to the environment while seeking and presenting viable solutions is a critical part of success. This delicate balance is critical in order to effectively identify and improve inefficiencies in management and teamwork settings. Although flexibility is a critical part of a person's future success (Coll & Zegwaard, 2006; Davies, 2009; Wellington, 2002), this is an area that is noticeably lacking in current graduates. Prince and Felder (2006) theorized that PBL's ill-structured environment may be helpful for this skill development.

Examination of the combined qualitative data gives strong evidence that an improvement did occur. This support is very strong ( $p < 0.001$ ) for all subcategories of the CVSS assessment tool. The qualitative data provides further support because students recognized specific examples of growth in adaptability as a result of PBL methods. This acknowledgement of adaptability provides additional support for others (Quinn, 2004; Stein & Book, 2000) who argued that flexibility is critical to overall success in leadership and management. As stated previously, the participants acknowledged that they learned from their experiences within the PBL ill-structured environment, and realized that they developed stronger skill sets to on how to interact and adapt to their teammates.

Chapter 1 described how early researchers (Thaimhain, 1992) identified management as a major category that inhibits project success. Although this is an apparent problem, some authors (Bishop, 1996) argued that management, ethics, bid preparation and communication can only be learned in the professional world. Others have argued (Prince & Felder, 2006; Ribeiro & Mizukami, 2005; Zolin et al., 2003) that PBL can help this transition since it is not in a traditional lecture setting (Cano et al., 2006). These differences in learning styles may be a contributing factor in the variety of approaches and resolutions to challenging scenarios in the world of work in the construction industry.

The management competency revealed positive changes of the participants' summarized quantitative and qualitative information. In the combined management section of the quantitative data, the results show improvement with statistical significance ( $p < 0.05$ ) for all the subcategories. Furthermore, the qualitative portion indicates that the participants' exposure to multiple skill sets and interactions offered the participants the ability to better understand how different interactions affect the project and how management coordinates these efforts.

Participants recognized and acknowledged the close associations between management and people skills, as well as how the learning opportunity allowed them to enhance their skills in these areas. This recognition supports the value of trust (Zolin et al., 2003) and the collaboration of teamwork, leadership, and interpersonal skills (Coll & Zegwaard, 2006) described by prior authors.

**PBL effect**

Perhaps another area of interest was not only the realization of participants of their improvement within a short period of time but, more importantly, the reason they had made this advancement. These predominant themes were recognized during the qualitative review: confidence, realization of their capacity, and an overall positive feeling about their future efforts to apply these new skills. In addition, the participants' increased capacity to understand the interaction and struggles between independence and teamwork, and how to establish and maintain the relationship became apparent.

Participants soon realized through their interactions with others how teamwork, interpersonal skills, and leadership styles apply to both their professional and personal settings. As identified throughout the qualitative written comments, participants found methods to maximize the team's efforts, integrate knowledge and skills to provide innovative solutions, and realized the importance of the responsibility of being a team player. They appreciated the opportunity to apply their skills in a real life situation and this interaction helped contribute to their confidence.

While some noted that the team dynamics and time management contributed to their stress, several others appreciated this real life experience, and understood how it was contributing to their overall success. This became further apparent when they indicated a sense of surprise and appreciation of these new increased skill sets. Throughout the review, the acknowledgment of the critical importance of the class, the style of delivery, and its relevance to their overall future success was well-documented.

The development through real-life, ill-structured problems, was recognized as a major part of this success. It was further commented that this PBL method provides the stepping

stones for future learning, invaluable for construction engineering graduates, and a pivotal piece in the overall success of the program.

### **Implications for Practice**

This study provides additional value to ongoing research regarding the potential changes that may occur through PBL. The literature reviewed in Chapter 2 supports the importance of soft skills to the construction industry, and also documents the need to make changes in order to fulfill such a future direction.

This study provides various implications for students and educators, industry, and academia organizations. First, the work contributes to the existing literature on the potential changes that PBL can provide in an educational environment. Second, this study confirmed changes in leading variables that have been identified as needed in the future of the practitioner. These findings support the theory that soft skills can be taught in an academic setting. Third, this study provides an important contribution for the support and implementation of PBL in an academic setting.

### **Future Study**

It is apparent that several parties are key players in the development of student soft skills and educational advancement. However, in order for this partnership to flourish, all parties must be willing participants in educational change.

Major documented changes have occurred before in the engineering educational system. Roesset and Yao (2002) referenced a historical shift in the engineering education system in the 1950s. They found that education made a shift to a more theoretical approach partly due to a need to develop graduate students and pursue additional funding. Along with

others, Sinha et al. (2002) determined that this shift was partially created at the expense of the practical art of engineering.

PBL may be a method that could be applied to re-incorporate realistic ill-structured realistic problems back into the classroom. In fact, several of the participants in this study identified that PBL provided several of the required soft skills. However, a successful transition to PBL teaching methods would require all parties to understand the importance of the value that PBL can provide in the future, because developing this process not only involves the students and faculty, but also includes industry and academic administration. Each of these stakeholders must understand and agree upon how this transition could be effectively implemented.

### **Challenges**

Students play an important role in the success of any educational process. Although some researchers indicate that students want the hands-on practical approach of past engineering (Lamancusa et al., 2008), another study (Harfield et al., 2007) found that their students preferred structure (non-ambiguous) and shared responsibility (high level of instructor and supervisory oversight). To further complicate the student factor, Cano et al. (2006) indicated that, although most students appreciated the new management and teamwork skills learned through ill-structured problems, a small portion were unable to successfully manage the change. Therefore, since most students are unfamiliar with PBL methods, there must be a realization that some students will not initially readily adapt to the change and may not likely enjoy a PBL course.



Despite this potential issue, Walesh (1999) strongly suggested providing and expanding upon this type of teamwork instruction and experience. Adding to the student confusion, Bernold (2007) argued that students may not be capable of determining what is good teaching and therefore students' perspective should be viewed cautiously. Herein lays part of the student dilemma. Successfully addressing some of these issues will help the students gain a better understanding of some of the challenges and subsequent benefits.

Faculty are another key part of the success of any proposed educational change. First, the challenges that are holding back faculty from pursuing PBL methods need to be identified and addressed. Second, if this change is in the students' best interests, the reasons that students are not requesting such a change need to be identified.

Some faculty may be hesitant to make changes due to the perceived overall risk in pursuing an alternate learning style. Since PBL typically makes students responsible for a major part of their own learning, it has been argued that resentment and poor teaching evaluations can follow which may inhibit instructors' future use of PBL (Prince & Felder 2006). Another study has revealed that such student-centered teaching practices are viewed as ineffective by students, and that students again will rate poorly any instructor who might pursue such attempts (Bernold, 2007). Thus, the fear of poor teaching evaluations in a university culture—where peer evaluation, limited resources, and faculty resistance can be prevalent—is likely to be a limiting factor to such pursuit.

In regards to students requesting this change, it has been argued that part of the issue is that students typically will pursue a path of least resistance and, therefore, that engineering educators must be the parties to initiate the change (Gilleard & Gilleard, 2002). In addition, students would have to be aware of the advantages of PBL in order to become better able to

request its implementation. Therefore, faculty will have to make the change to a student-centered paradigm on their own.

Roselli and Brophy (2006) stated that the potential challenge of PBL success appears to rely on a balance between self-learning styles and the skills of the instructor. Other authors (Prince & Felder, 2006) have voiced similar observations, while others (Roesset et al., 2002) have specifically mentioned the difficulty of finding faculty who may be better prepared to facilitate this method of learning. Farr and Merino (2002) also went so far as to state that most faculty members have little industry experience, and are promoted for technical skills and not practical business abilities. If a faculty member does not understand the advantages, feels uncomfortable or intimidated by student initial reactions (Prince & Felder, 2006), or does not perceive and support any benefits, it is unlikely that they will champion the change.

Chapter 2 detailed the numerous industry and organizational needs and reasons for changes in the engineering educational system. Whether it is from years of survey data provided by professional consultants (FMI), industry studies by Thomas et al. (1998) and Klinger (1956), or other researchers such as Bernold (2007), Guishgari et al. (1997) or Odusami (2002) have helped document the industry's need for soft skills. While some (Farr & Merino, 2002) have acknowledged the challenges of such incorporation into academia, others (Shuman et al., 2005) have stated that the new directives of incorporating soft skills from organizations such as ABET and ASCE are perhaps the most important changes in engineering education in 15 years. The field is at an important crossroads.

Several authors (Jonassen et al., 2006; Lamancusa et al., 2008; Prince et al., 2007, Ribeiro & Mizukami 2005; Russell & Yao, 1996; Yeo, 2005,) have suggested that the

required change will demand support from various players in the educational process. These authors posited that academia policy-makers may need to be the more prominent leaders in this change. However, some have pointed out (Turns et al., 2007) that there may be a conflict providing a culture that values teaching. Like many improvements to many systems, however, it will require the skills and efforts of all concerned parties in order to maximize its performance and success.

## CHAPTER 7. RECOMMENDATIONS AND CONCLUSION

Although providing soft skill competencies in students can be a monumental task (Coll & Zegwaard, 2006), these skills are critical components to a student's success, and this study revealed that PBL appears to be a viable method of teaching these soft skills. Some universities (Purdue and Virginia Tech) have already begun addressing this issue by developing specific programs focused on engineering education. The faculty who are charged with providing future engineers may be able to successfully adopt the PBL method and facilitate holistic learning.

All parties have a significant vested interest in improving the engineering educational system. The results of this study may help bridge this gap as people become better informed and more a part of the process. As people become better informed of the importance and value of PBL, collaborative teamwork may assure its success.

There is limited research on effectively teaching soft skills in undergraduate engineering. In addition, while there are a growing number of researchers on PBL, few have actually obtained evidence of the competencies affected. This study provides an opportunity for more research to be performed in engineering education, especially in the development of soft skills. A longitudinal study should be considered for Iowa State University to determine if similar findings are obtained in other engineering curriculums. In addition, this study could be further duplicated at other universities in order to determine if there are similar results.

During the review of the quantitative and qualitative data, it quickly became apparent that several competencies are affected by PBL. In some cases, it appeared that students

obtained a holistic experience that offered growth in several different categories beyond the hypothesis tested. Prior authors (Brown, 2004; Prince & Felder, 2006; Ribeiro & Mizukami, 2005) have suggested that PBL can increase such soft skills as communication, problem solving, and improved teamwork. Research could be conducted into what additional factors beyond the tested hypothesis are affected.

Research could also be conducted to review potential interaction of competencies through factor analysis. This method, which is based on the assumption that underlying factors affect the observed variables (Kim & Mueller, 1978), can further provide additional information on what factors may best determine the growth of soft skill competencies. Such a study could provide further insight into the interactions of various competencies, and be of further value to educational research.

The purpose of this study was to determine if PBL can affect certain soft skills of construction engineers. The results of this study suggest that PBL can positively influence several soft skills of senior construction engineers. In addition, the findings of the study suggest that confidence and stress coping, leadership and communication, and adaptability and management skills are all positively influenced. During this process, the results also suggest that students were influenced in a more holistic manner as they were influenced by the real world application that PBL provides. As the advantages of PBL come more to the forefront, more educators can take advantages of its strengths and add to the growing research. Through the collaborative efforts of all concerned entities, great strides in overcoming various perceived obstacles can be made in any type of educational system.

**APPENDIX A. HUMAN SUBJECTS APPROVAL****IOWA STATE UNIVERSITY**

Institutional Review Board Office of  
Research Assurances Vice Provost  
for Research 1138 Pearson Hall  
Ames, Iowa 50011-2207

**DATE:** December 6, 2005 Corrected Letter

515 294-4566 FAX

**TO:** Todd Sirotiak

515 294-4267

**FROM:** Office of Research Assurances

**RE:** IRS ID # 05-313

**STUDY REVIEW DATE:** December 5, 2005

The reassessment of the project, "Effect of Problem Based Learning on Emotional Intelligence" during the review, has been declared exempt from Federal regulations as described in 45 CFR 46.101(b)2.

To be in compliance with ISU's Federal Wide Assurance through the Office of Human Research Protections (OHRP) all projects involving human subjects, must be reviewed by the Institutional Review Board (IRB). Only the IR may determine if the project must follow the requirement of 45 CFR 46 or is exempt from the requirements in this la. Therefore, all human subject projects must be submitted and reviewed by the IRB.

Because this project is exempt it does not require further IRB review and is exempt from the Department of Health and Human Service (DHHS) regulations for the protection of human subjects.

We do, however, urge you to protect the rights of your participants in the same ways that you would if IRB approval were required. This includes providing relevant information about the research to the participants.

Any modification of this research should be submitted to the IRB on a Continuation and/or Modification form to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

cc: CCEE  
Russell Walters

## APPENDIX B. COURSE SYLLABUS

ConE 461  
 Spring 2006  
 Construction Engineering Design  
 Monday, Wednesday, and Friday 9-12

### Instructor:

Todd L. Sirotiak  
 Adjunct Assistant Professor  
 Civil and Construction Engineering  
 515-294-5424  
[sirotiak@iastate.edu](mailto:sirotiak@iastate.edu)

### IT Assistance

Grant Stephenson  
 IT SUPP  
 CCEE  
 515-294-6048  
[stephegr@iastate.edu](mailto:stephegr@iastate.edu)

### Partial list of references:

- The Architects Handbook of Professional Practice, AIA, Washington, D.C.
- R.S. Means Building Construction Cost Data, R.S. Means, New York, NY
- Design Cost Analysis for Architects and Engineers, Swinburne, McGraw- Hill, New York, NY
- Uniform Building Code
- Mechanical and Electrical Equipment for Buildings, Stein and Reynolds, Wiley, New York, NY
- Design-Build Manual of Practice, DBIA, Washington, D.C.

### Course Description:

Application of individual and team concepts to a construction project. Planning, analysis, cost and scheduling, contracts, documentation, and oral and written presentations.

This course is an opportunity to draw and implement your knowledge and skills obtained from previous courses, prior work experiences, extracurricular activities, and life experiences. This course is further intended to expand your level of understanding of subjects, create a more realistic work environment, and assist in preparation for what you may experience in your career.

Similar to a typical work experience, assignments may be performed individually and in a team atmosphere. In the teamwork activities, you will need to actively participate, become involved in development of products, concepts, presentations, etc.

Typical with several construction projects, the assignments may require that you and/or your team seek out sources of information from internal and external sources. You would be responsible for finding, correctly interpreting and implementing, analyzing, making correct valued decisions, and developing, documenting, and supporting decisions rendered.

**Note: If you have a documented disability that may affect your ability to participate fully in the course or if you require special accommodations, you are encouraged to speak with the instructor so that appropriate accommodations can be arranged.**

*Your career will involve decisions made under stress, pressure, and without complete information, etc. This course is intended to mirror this potential situation. How well you operate under these conditions could assist you in your future endeavors. Risk, pressure, interactions, and prompt decisions are part of the business that you have elected to pursue. Practice in these areas may help you in your future career.*

### **Course Objectives:**

The objectives of this course are to:

1. demonstrate competency in all phases of project planning, engineering and management at the project level
2. understand and handle the uncertainties involved in planning, decision-making, for project situations and organizations
3. understand the relationships between decisions of the owner, designers, and contractors
4. demonstrate methods of written and oral communication within the work environment
5. demonstrate effective skills and accomplishment of complex and challenging objectives
6. experience different formats of communication techniques

### **Assessment:**

This course will have various methods of evaluation (written, oral reports, etc.). There will be a major presentation, turnover of documentation in a project and course notebook. Written, advance assignments will assist you in meeting requirements and expectations. Tests, quizzes, reviews may be graded accordingly on a holistic approach.

Course Grades: The approximate grading scale will be as follows:

92 +	A	78-80	C+
90-92	A-	73-78	C
88-90	B+	70-73	C-
83-88	B	65-70	D
80-83	B-	Below	F

### **Course Policies:**

You are expected to be present in class each day for the whole class period. Attendance will be recorded. Unexcused absences will reduce your grade. If you are required to be absent, you must request in advance (in writing) and approval must be granted (exception-emergency absent, etc.). In the written advance absence, you must state the reason, and be responsible for a teammate, etc. to pick up handouts, etc. You are expected to schedule outside activities (including potential interviews) so not to be absent from ConE461. Each team will prepare and submit a time sheet documenting actual hours spent by each team member. A copy of this will be retained as part of your permanent records.

Per business practice, a submitted report or other document typically needs a transmitting letter and/or memo. This correspondence serves several purposes. It creates a signed record of who approved and authorized its release (signed by proper authority), the transmission date, and record of the document distributed. It lets the recipient know the status, content, and other information related but may not be contained within the submittal.



Each submittal in class will have a formal transmittal document. When the submittal is within the company, it should be on a MEMO form. When the transmittal goes outside the organization, the transmittal should be on a LETTER format with the company letterhead.

The class will typically meet in Room 210 of Town Engineering. This room is being set aside for the use on a 24 hour basis. The classroom has a special lock and will have a security entrance. Do not give entrance to others or you and/or others may lose your privilege to utilize this room.

Lockers are available in various parts of this building (ex: 106, etc.). This may provide other areas to store items and or reference materials that you and/or your group may collect and/or borrow. Utilization of other computers (ex: 106B, etc.) is also acceptable during the performance of your coursework

## APPENDIX C. STATISTICAL DATA

## C-1. T-Test F05 EQi 133 – F05 Paired Samples Statistics EQi

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	<b>TOTAL_EQ1</b>	102.62	21	8.623	1.882
	<b>TOTAL_EQ</b>	104.52	21	11.347	2.476
Pair 2	<b>INTRAPERSONAL1</b>	103.14	21	9.789	2.136
	<b>INTRAPERSONAL</b>	104.95	21	12.659	2.762
Pair 3	<i>SELF_REGARD1</i>	102.57	21	8.975	1.959
	<i>SELF_REGARD</i>	103.62	21	13.444	2.934
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1</i>	99.67	21	13.093	2.857
	<i>EMOTIONAL_SELF_AWARENESS</i>	104.05	21	11.599	2.531
Pair 5	<i>ASSERTIVENESS1</i>	103.90	21	13.003	2.838
	<i>ASSERTIVENESS</i>	105.48	21	10.230	2.232
Pair 6	<i>INDEPENDENCE1</i>	101.71	21	13.668	2.983
	<i>INDEPENDENCE</i>	102.71	21	14.139	3.085
Pair 7	<i>SELF_ACTUALIZATION1</i>	105.43	21	7.427	1.621
	<i>SELF_ACTUALIZATION</i>	103.76	21	13.375	2.919
Pair 8	<b>INTERPERSONAL1</b>	98.29	21	10.412	2.272
	<b>INTERPERSONAL</b>	100.19	21	11.566	2.524
Pair 9	<i>EMPATHY1</i>	97.57	21	9.400	2.051
	<i>EMPATHY</i>	102.48	21	11.741	2.562
Pair 10	<i>SOCIAL_RESPONSIBILITY1</i>	99.05	21	10.712	2.338
	<i>SOCIAL_RESPONSIBILITY</i>	99.52	21	11.622	2.536
Pair 11	<b>INTERPERSONAL_RELATIONSHIP1</b>	98.43	21	10.689	2.333
	<b>INTERPERSONAL_RELATIONSHIP</b>	99.43	21	14.431	3.149
Pair 12	<i>STRESS_MANAGEMENT1</i>	103.33	21	8.181	1.785
	<i>STRESS_MANAGEMENT</i>	104.81	21	9.522	2.078
Pair 13	<i>STRESS_TOLERANCE1</i>	101.19	21	9.983	2.178
	<i>STRESS_TOLERANCE</i>	104.00	21	10.242	2.235
Pair 14	<i>IMPULSE_CONTROL1</i>	104.43	21	11.417	2.491
	<i>IMPULSE_CONTROL</i>	104.29	21	13.237	2.889
Pair 15	<b>ADAPTABILITY1</b>	103.14	21	10.887	2.376
	<b>ADAPTABILITY</b>	106.62	21	9.646	2.105
Pair 16	<i>REALITY_TESTING1</i>	103.86	21	14.214	3.102
	<i>REALITY_TESTING</i>	107.57	21	12.069	2.634
Pair 17	<i>FLEXIBILITY1</i>	101.43	21	14.641	3.195
	<i>FLEXIBILITY</i>	104.29	21	13.123	2.864
Pair 18	<i>PROBLEM_SOLVING1</i>	102.19	21	8.292	1.810
	<i>PROBLEM_SOLVING</i>	104.38	21	7.159	1.562
Pair 19	<b>GENERAL_MOOD1</b>	103.76	21	6.999	1.527
	<b>GENERAL_MOOD</b>	102.52	21	13.193	2.879
Pair 20	<i>OPTIMISM1</i>	101.81	21	9.158	1.998
	<i>OPTIMISM</i>	102.76	21	12.601	2.750
Pair 21	<i>HAPPINESS1</i>	104.90	21	6.610	1.442
	<i>HAPPINESS</i>	102.14	21	12.788	2.791

**F05 Paired Samples Correlations EQi**

		N	Correlation	Sig.
Pair 1	<b>TOTAL_EQ1 &amp; TOTAL_EQ</b>	21	.770	.000
Pair 2	<b>INTRAPERSONAL1 &amp; INTRAPERSONAL</b>	21	.767	.000
Pair 3	<i>SELF_REGARD1 &amp; SELF_REGARD</i>	21	.608	.003
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 &amp; EMOTIONAL_SELF_AWARENESS</i>	21	.843	.000
Pair 5	<i>ASSERTIVENESS1 &amp; ASSERTIVENESS</i>	21	.632	.002
Pair 6	<i>INDEPENDENCE1 &amp; INDEPENDENCE</i>	21	.769	.000
Pair 7	<i>SELF_ACTUALIZATION1 &amp; SELF_ACTUALIZATION</i>	21	.594	.005
Pair 8	<b>INTERPERSONAL1 &amp; INTERPERSONAL</b>	21	.805	.000
Pair 9	<i>EMPATHY1 &amp; EMPATHY</i>	21	.849	.000
Pair 10	<i>SOCIAL_RESPONSIBILITY1 &amp; SOCIAL_RESPONSIBILITY</i>	21	.561	.008
Pair 11	<b>INTERPERSONAL_RELATIONSHIP1 &amp; INTERPERSONAL_RELATIONSHIP</b>	21	.845	.000
Pair 12	<i>STRESS_MANAGEMENT1 &amp; STRESS_MANAGEMENT</i>	21	.702	.000
Pair 13	<i>STRESS_TOLERANCE1 &amp; STRESS_TOLERANCE</i>	21	.600	.004
Pair 14	<i>IMPULSE_CONTROL1 &amp; IMPULSE_CONTROL</i>	21	.851	.000
Pair 15	<b>ADAPTABILITY1 &amp; ADAPTABILITY</b>	21	.695	.000
Pair 16	<i>REALITY_TESTING1 &amp; REALITY_TESTING</i>	21	.783	.000
Pair 17	<i>FLEXIBILITY1 &amp; FLEXIBILITY</i>	21	.635	.002
Pair 18	<i>PROBLEM_SOLVING1 &amp; PROBLEM_SOLVING</i>	21	.335	.138
Pair 19	<b>GENERAL_MOOD1 &amp; GENERAL_MOOD</b>	21	.575	.006
Pair 20	<i>OPTIMISM1 &amp; OPTIMISM</i>	21	.440	.046
Pair 21	<i>HAPPINESS1 &amp; HAPPINESS</i>	21	.577	.006

## F05 Paired Samples Test EQi

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	<b>TOTAL_EQ1 – TOTAL_EQ</b>	-1.905	7.238	1.579	-5.200	1.390	-1.206	20	.242
Pair 2	<b>INTRAPERSONAL1 – INTRAPERSONAL</b>	-1.810	8.122	1.772	-5.506	1.887	-1.021	20	.319
Pair 3	<i>SELF_REGARD1 - SELF_REGARD</i>	-1.048	10.703	2.336	-5.919	3.824	-.449	20	.659
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 - EMOTIONAL_SELF_AWARENESS</i>	-4.381	7.067	1.542	-7.598	-1.164	-2.841	20	.010
Pair 5	<i>ASSERTIVENESS1 – ASSERTIVENESS</i>	-1.571	10.274	2.242	-6.248	3.105	-.701	20	.491
Pair 6	<i>INDEPENDENCE1 – INDEPENDENCE</i>	-1.000	9.466	2.066	-5.309	3.309	-.484	20	.634
Pair 7	<i>SELF_ACTUALIZATION1 - SELF_ACTUALIZATION</i>	1.667	10.772	2.351	-3.237	6.570	.709	20	.486
Pair 8	<b>INTERPERSONAL1 – INTERPERSONAL</b>	-1.905	6.949	1.516	-5.068	1.258	-1.256	20	.224
Pair 9	<i>EMPATHY1 – EMPATHY</i>	-4.905	6.228	1.359	-7.740	-2.070	-3.609	20	.002
Pair 10	<i>SOCIAL_RESPONSIBILITY1 - SOCIAL_RESPONSIBILITY</i>	-.476	10.491	2.289	-5.252	4.299	-.208	20	.837
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1 - INTERPERSONAL_RELATIONSHIP</i>	-1.000	7.861	1.715	-4.578	2.578	-.583	20	.566
Pair 12	<b>STRESS_MANAGEMENT1 – STRESS_MANAGEMENT</b>	-1.476	6.947	1.516	-4.638	1.686	-.974	20	.342
Pair 13	<i>STRESS_TOLERANCE1 – STRESS_TOLERANCE</i>	-2.810	9.053	1.976	-6.931	1.311	-1.422	20	.170
Pair 14	<i>IMPULSE_CONTROL1 - IMPULSE_CONTROL</i>	.143	6.959	1.519	-3.025	3.311	.094	20	.926
Pair 15	<b>ADAPTABILITY1 – ADAPTABILITY</b>	-3.476	8.103	1.768	-7.165	.212	-1.966	20	.063
Pair 16	<i>REALITY_TESTING1 – REALITY_TESTING</i>	-3.714	8.889	1.940	-7.761	.332	-1.915	20	.070
Pair 17	<i>FLEXIBILITY1 – FLEXIBILITY</i>	-2.857	11.934	2.604	-8.290	2.575	-1.097	20	.286
Pair 18	<i>PROBLEM_SOLVING1 – PROBLEM_SOLVING</i>	-2.190	8.959	1.955	-6.269	1.888	-1.120	20	.276
Pair 19	<b>GENERAL_MOOD1 – GENERAL_MOOD</b>	1.238	10.812	2.359	-3.683	6.159	.525	20	.606
Pair 20	<i>OPTIMISM1 – OPTIMISM</i>	-.952	11.876	2.592	-6.358	4.454	-.367	20	.717
Pair 21	<i>HAPPINESS1 – HAPPINESS</i>	2.762	10.473	2.285	-2.005	7.529	1.208	20	.241

**C-2. T-Test S06 EQi 133 S06 Paired Samples Statistics EQi**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	<b>TOTAL_EQ1</b>	103.46	37	10.156	1.670
	<b>TOTAL_EQ</b>	104.05	37	10.580	1.739
Pair 2	<b>INTRAPERSONAL1</b>	103.00	37	11.015	1.811
	<b>INTRAPERSONAL</b>	104.73	37	10.782	1.773
Pair 3	<i>SELF_REGARD1</i>	101.43	37	10.460	1.720
	<i>SELF_REGARD</i>	103.32	37	8.505	1.398
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1</i>	102.86	37	12.063	1.983
	<i>EMOTIONAL_SELF_AWARENESS</i>	102.11	37	11.789	1.938
Pair 5	<i>ASSERTIVENESS1</i>	101.76	37	10.560	1.736
	<i>ASSERTIVENESS</i>	104.43	37	11.179	1.838
Pair 6	<i>INDEPENDENCE1</i>	102.08	37	11.882	1.953
	<i>INDEPENDENCE</i>	104.22	37	10.602	1.743
Pair 7	<i>SELF_ACTUALIZATION1</i>	104.59	37	10.558	1.736
	<i>SELF_ACTUALIZATION</i>	106.00	37	11.662	1.917
Pair 8	<b>INTERPERSONAL1</b>	102.86	37	10.377	1.706
	<b>INTERPERSONAL</b>	102.19	37	12.229	2.010
Pair 9	<i>EMPATHY1</i>	102.19	37	12.514	2.057
	<i>EMPATHY</i>	102.59	37	12.904	2.121
Pair 10	<i>SOCIAL_RESPONSIBILITY1</i>	103.16	37	9.590	1.577
	<i>SOCIAL_RESPONSIBILITY</i>	101.57	37	11.044	1.816
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1</i>	102.27	37	11.787	1.938
	<i>INTERPERSONAL_RELATIONSHIP</i>	102.46	37	12.903	2.121
Pair 12	<b>STRESS_MANAGEMENT1</b>	103.41	37	10.810	1.777
	<b>STRESS_MANAGEMENT</b>	103.32	37	10.507	1.727
Pair 13	<i>STRESS_TOLERANCE1</i>	101.68	37	12.157	1.999
	<i>STRESS_TOLERANCE</i>	105.22	37	9.578	1.575
Pair 14	<i>IMPULSE_CONTROL1</i>	103.86	37	11.724	1.927
	<i>IMPULSE_CONTROL</i>	100.65	37	12.887	2.119
Pair 15	<b>ADAPTABILITY1</b>	101.95	37	10.721	1.763
	<b>ADAPTABILITY</b>	102.46	37	10.189	1.675
Pair 16	<i>REALITY_TESTING1</i>	103.03	37	10.902	1.792
	<i>REALITY_TESTING</i>	103.22	37	11.126	1.829
Pair 17	<i>FLEXIBILITY1</i>	101.27	37	11.367	1.869
	<i>FLEXIBILITY</i>	101.59	37	11.413	1.876
Pair 18	<i>PROBLEM_SOLVING1</i>	100.59	37	11.661	1.917
	<i>PROBLEM_SOLVING</i>	101.30	37	10.705	1.760
Pair 19	<b>GENERAL_MOOD1</b>	105.89	37	8.653	1.423
	<b>GENERAL_MOOD</b>	106.89	37	9.171	1.508
Pair 20	<i>OPTIMISM1</i>	104.57	37	9.720	1.598
	<i>OPTIMISM</i>	105.46	37	9.051	1.488
Pair 21	<i>HAPPINESS1</i>	106.46	37	8.408	1.382
	<i>HAPPINESS</i>	107.35	37	9.449	1.553

**S06 Paired Samples Correlations EQi**

		N	Correlation	Sig.
Pair 1	<b>TOTAL_EQ1 &amp; TOTAL_EQ</b>	37	.778	.000
Pair 2	<b>INTRAPERSONAL1 &amp; INTRAPERSONAL</b>	37	.741	.000
Pair 3	<i>SELF_REGARD1 &amp; SELF_REGARD</i>	37	.606	.000
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 &amp; EMOTIONAL_SELF_AWARENESS</i>	37	.777	.000
Pair 5	<i>ASSERTIVENESS1 &amp; ASSERTIVENESS</i>	37	.718	.000
Pair 6	<i>INDEPENDENCE1 &amp; INDEPENDENCE</i>	37	.743	.000
Pair 7	<i>SELF_ACTUALIZATION1 &amp; SELF_ACTUALIZATION</i>	37	.749	.000
Pair 8	<b>INTERPERSONAL1 &amp; INTERPERSONAL</b>	37	.801	.000
Pair 9	<i>EMPATHY1 &amp; EMPATHY</i>	37	.690	.000
Pair 10	<i>SOCIAL_RESPONSIBILITY1 &amp; SOCIAL_RESPONSIBILITY</i>	37	.703	.000
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1 &amp; INTERPERSONAL_RELATIONSHIP</i>	37	.760	.000
Pair 12	<b>STRESS_MANAGEMENT1 &amp; STRESS_MANAGEMENT</b>	37	.797	.000
Pair 13	<i>STRESS_TOLERANCE1 &amp; STRESS_TOLERANCE</i>	37	.660	.000
Pair 14	<i>IMPULSE_CONTROL1 &amp; IMPULSE_CONTROL</i>	37	.829	.000
Pair 15	<b>ADAPTABILITY1 &amp; ADAPTABILITY</b>	37	.739	.000
Pair 16	<i>REALITY_TESTING1 &amp; REALITY_TESTING</i>	37	.657	.000
Pair 17	<i>FLEXIBILITY1 &amp; FLEXIBILITY</i>	37	.725	.000
Pair 18	<i>PROBLEM_SOLVING1 &amp; PROBLEM_SOLVING</i>	37	.603	.000
Pair 19	<b>GENERAL_MOOD1 &amp; GENERAL_MOOD</b>	37	.728	.000
Pair 20	<i>OPTIMISM1 &amp; OPTIMISM</i>	37	.580	.000
Pair 21	<i>HAPPINESS1 &amp; HAPPINESS</i>	37	.809	.000

## S06 Paired Samples Test EQi

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	Upper	Lower			
Pair 1	<b>TOTAL_EQ1 – TOTAL_EQ</b>	-.595	6.918	1.137	-2.901	1.712	-.523	36	.604
Pair 2	<b>INTRAPERSONAL1 – INTRAPERSONAL</b>	-1.730	7.852	1.291	-4.348	.888	-1.340	36	.189
Pair 3	<i>SELF_REGARD1 - SELF_REGARD</i>	-1.892	8.602	1.414	-4.760	.976	-1.338	36	.189
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 - EMOTIONAL_SELF_AWARENESS</i>	.757	7.963	1.309	-1.898	3.412	.578	36	.567
Pair 5	<i>ASSERTIVENESS1 – ASSERTIVENESS</i>	-2.676	8.179	1.345	-5.403	.051	-1.990	36	.054
Pair 6	<i>INDEPENDENCE1 – INDEPENDENCE</i>	-2.135	8.155	1.341	-4.854	.584	-1.593	36	.120
Pair 7	<i>SELF_ACTUALIZATION1 - SELF_ACTUALIZATION</i>	-1.405	7.935	1.305	-4.051	1.240	-1.077	36	.289
Pair 8	<b>INTERPERSONAL1 – INTERPERSONAL</b>	.676	7.352	1.209	-1.776	3.127	.559	36	.580
Pair 9	<i>EMPATHY1 - EMPATHY</i>	-.405	10.007	1.645	-3.742	2.931	-.246	36	.807
Pair 10	<i>SOCIAL_RESPONSIBILITY1 - SOCIAL_RESPONSIBILITY</i>	1.595	8.067	1.326	-1.095	4.284	1.202	36	.237
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1 - INTERPERSONAL_RELATIONSHIP</i>	-.189	8.618	1.417	-3.063	2.684	-.134	36	.895
Pair 12	<b>STRESS_MANAGEMENT1 - STRESS_MANAGEMENT</b>	.081	6.796	1.117	-2.185	2.347	.073	36	.943
Pair 13	<i>STRESS_TOLERANCE1 - STRESS_TOLERANCE</i>	-3.541	9.266	1.523	-6.630	-.451	-2.324	36	.026
Pair 14	<i>IMPULSE_CONTROL1 - IMPULSE_CONTROL</i>	3.216	7.277	1.196	.790	5.642	2.688	36	.011
Pair 15	<b>ADAPTABILITY1 – ADAPTABILITY</b>	-.514	7.574	1.245	-3.039	2.012	-.412	36	.682
Pair 16	<i>REALITY_TESTING1 - REALITY_TESTING</i>	-.189	9.119	1.499	-3.230	2.851	-.126	36	.900
Pair 17	<i>FLEXIBILITY1 – FLEXIBILITY</i>	-.324	8.440	1.387	-3.138	2.490	-.234	36	.816
Pair 18	<i>PROBLEM_SOLVING1 – PROBLEM_SOLVING</i>	-.703	10.005	1.645	-4.039	2.633	-.427	36	.672
Pair 19	<b>GENERAL_MOOD1 – GENERAL_MOOD</b>	-1.000	6.595	1.084	-3.199	1.199	-.922	36	.363
Pair 20	<i>OPTIMISM1 - OPTIMISM</i>	-.892	8.618	1.417	-3.765	1.981	-.630	36	.533
Pair 21	<i>HAPPINESS1 – HAPPINESS</i>	-.892	5.602	.921	-2.760	.976	-.969	36	.339

**C-3. T-Test EQi 133 F05 and S06 Combined Paired Samples Statistics EQi**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	<b>TOTAL_EQ1</b>	103.16	58	9.560	1.255
	<b>TOTAL_EQ</b>	104.22	58	10.767	1.414
Pair 2	<b>INTRAPERSONAL1</b>	103.05	58	10.500	1.379
	<b>INTRAPERSONAL</b>	104.81	58	11.387	1.495
Pair 3	<i>SELF_REGARD1</i>	101.84	58	9.883	1.298
	<i>SELF_REGARD</i>	103.43	58	10.446	1.372
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1</i>	101.71	58	12.428	1.632
	<i>EMOTIONAL_SELF_AWARENESS</i>	102.81	58	11.657	1.531
Pair 5	<i>ASSERTIVENESS1</i>	102.53	58	11.439	1.502
	<i>ASSERTIVENESS</i>	104.81	58	10.766	1.414
Pair 6	<i>INDEPENDENCE1</i>	101.95	58	12.440	1.633
	<i>INDEPENDENCE</i>	103.67	58	11.902	1.563
Pair 7	<i>SELF_ACTUALIZATION1</i>	104.90	58	9.483	1.245
	<i>SELF_ACTUALIZATION</i>	105.19	58	12.241	1.607
Pair 8	<b>INTERPERSONAL1</b>	101.21	58	10.534	1.383
	<b>INTERPERSONAL</b>	101.47	58	11.930	1.566
Pair 9	<i>EMPATHY1</i>	100.52	58	11.616	1.525
	<i>EMPATHY</i>	102.55	58	12.392	1.627
Pair 10	<i>SOCIAL_RESPONSIBILITY1</i>	101.67	58	10.116	1.328
	<i>SOCIAL_RESPONSIBILITY</i>	100.83	58	11.199	1.470
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1</i>	100.88	58	11.459	1.505
	<i>INTERPERSONAL_RELATIONSHIP</i>	101.36	58	13.430	1.763
Pair 12	<b>STRESS_MANAGEMENT1</b>	103.38	58	9.864	1.295
	<b>STRESS_MANAGEMENT</b>	103.86	58	10.102	1.326
Pair 13	<i>STRESS_TOLERANCE1</i>	101.50	58	11.330	1.488
	<i>STRESS_TOLERANCE</i>	104.78	58	9.751	1.280
Pair 14	<i>IMPULSE_CONTROL1</i>	104.07	58	11.516	1.512
	<i>IMPULSE_CONTROL</i>	101.97	58	13.018	1.709
Pair 15	<b>ADAPTABILITY1</b>	102.38	58	10.701	1.405
	<b>ADAPTABILITY</b>	103.97	58	10.113	1.328
Pair 16	<i>REALITY_TESTING1</i>	103.33	58	12.088	1.587
	<i>REALITY_TESTING</i>	104.79	58	11.565	1.519
Pair 17	<i>FLEXIBILITY1</i>	101.33	58	12.523	1.644
	<i>FLEXIBILITY</i>	102.57	58	12.016	1.578
Pair 18	<i>PROBLEM_SOLVING1</i>	101.17	58	10.517	1.381
	<i>PROBLEM_SOLVING</i>	102.41	58	9.623	1.264
Pair 19	<b>GENERAL_MOOD1</b>	105.12	58	8.096	1.063
	<b>GENERAL_MOOD</b>	105.31	58	10.894	1.430
Pair 20	<i>OPTIMISM1</i>	103.57	58	9.533	1.252
	<i>OPTIMISM</i>	104.48	58	10.448	1.372
Pair 21	<i>HAPPINESS1</i>	105.90	58	7.781	1.022
	<i>HAPPINESS</i>	105.47	58	10.961	1.439



**Combined Paired Samples Correlations EQi**

		N	Correlation	Sig.
Pair 1	<b>TOTAL_EQ1 &amp; TOTAL_EQ</b>	58	.769	.000
Pair 2	<b>INTRAPERSONAL1 &amp; INTRAPERSONAL</b>	58	.744	.000
Pair 3	<i>SELF_REGARD1 &amp; SELF_REGARD</i>	58	.580	.000
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 &amp; EMOTIONAL_SELF_AWARENESS</i>	58	.782	.000
Pair 5	<i>ASSERTIVENESS1 &amp; ASSERTIVENESS</i>	58	.679	.000
Pair 6	<i>INDEPENDENCE1 &amp; INDEPENDENCE</i>	58	.752	.000
Pair 7	<i>SELF_ACTUALIZATION1 &amp; SELF_ACTUALIZATION</i>	58	.677	.000
Pair 8	<b>INTERPERSONAL1 &amp; INTERPERSONAL</b>	58	.798	.000
Pair 9	<i>EMPATHY1 &amp; EMPATHY</i>	58	.719	.000
Pair 10	<i>SOCIAL_RESPONSIBILITY1 &amp; SOCIAL_RESPONSIBILITY</i>	58	.649	.000
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1 &amp; INTERPERSONAL_RELATIONSHIP</i>	58	.789	.000
Pair 12	<b>STRESS_MANAGEMENT1 &amp; STRESS_MANAGEMENT</b>	58	.766	.000
Pair 13	<i>STRESS_TOLERANCE1 &amp; STRESS_TOLERANCE</i>	58	.635	.000
Pair 14	<i>IMPULSE_CONTROL1 &amp; IMPULSE_CONTROL</i>	58	.832	.000
Pair 15	<b>ADAPTABILITY1 &amp; ADAPTABILITY</b>	58	.718	.000
Pair 16	<i>REALITY_TESTING1 &amp; REALITY_TESTING</i>	58	.704	.000
Pair 17	<i>FLEXIBILITY1 &amp; FLEXIBILITY</i>	58	.680	.000
Pair 18	<i>PROBLEM_SOLVING1 &amp; PROBLEM_SOLVING</i>	58	.550	.000
Pair 19	<b>GENERAL_MOOD1 &amp; GENERAL_MOOD</b>	58	.649	.000
Pair 20	<i>OPTIMISM1 &amp; OPTIMISM</i>	58	.520	.000
Pair 21	<i>HAPPINESS1 &amp; HAPPINESS</i>	58	.699	.000

## Combined Paired Samples Test EQi

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	Upper	Lower			
Pair 1	<b>TOTAL_EQ1 – TOTAL_EQ</b>	-1.069	7.001	.919	-2.910	.772	-1.163	57	.250
Pair 2	<b>INTRAPERSONAL1 – INTRAPERSONAL</b>	-1.759	7.879	1.035	-3.830	.313	-1.700	57	.095
Pair 3	<i>SELF_REGARD1 - SELF_REGARD</i>	-1.586	9.332	1.225	-4.040	.868	-1.294	57	.201
Pair 4	<i>EMOTIONAL_SELF_AWARENESS1 - EMOTIONAL_SELF_AWARENESS</i>	-1.103	7.986	1.049	-3.203	.996	-1.052	57	.297
Pair 5	<i>ASSERTIVENESS1 – ASSERTIVENESS</i>	-2.276	8.920	1.171	-4.621	.070	-1.943	57	.057
Pair 6	<i>INDEPENDENCE1 – INDEPENDENCE</i>	-1.724	8.588	1.128	-3.982	.534	-1.529	57	.132
Pair 7	<i>SELF_ACTUALIZATION1 - SELF_ACTUALIZATION</i>	-.293	9.094	1.194	-2.684	2.098	-.245	57	.807
Pair 8	<b>INTERPERSONAL1 – INTERPERSONAL</b>	-.259	7.256	.953	-2.167	1.649	-.271	57	.787
Pair 9	<i>EMPATHY1 – EMPATHY</i>	-2.034	9.034	1.186	-4.410	.341	-1.715	57	.092
Pair 10	<i>SOCIAL_RESPONSIBILITY1 - SOCIAL_RESPONSIBILITY</i>	.845	8.985	1.180	-1.518	3.207	.716	57	.477
Pair 11	<i>INTERPERSONAL_RELATIONSHIP1 - INTERPERSONAL_RELATIONSHIP</i>	-.483	8.291	1.089	-2.663	1.697	-.443	57	.659
Pair 12	<b>STRESS_MANAGEMENT1 - STRESS_MANAGEMENT</b>	-.483	6.832	.897	-2.279	1.314	-.538	57	.593
Pair 13	<i>STRESS_TOLERANCE1 - STRESS_TOLERANCE</i>	-3.276	9.117	1.197	-5.673	-.879	-2.737	57	.008
Pair 14	<i>IMPULSE_CONTROL1 - IMPULSE_CONTROL</i>	2.103	7.256	.953	.195	4.011	2.208	57	.031
Pair 15	<b>ADAPTABILITY1 – ADAPTABILITY</b>	-1.586	7.832	1.028	-3.645	.473	-1.542	57	.128
Pair 16	<i>REALITY_TESTING1 - REALITY_TESTING</i>	-1.466	9.120	1.197	-3.863	.932	-1.224	57	.226
Pair 17	<i>FLEXIBILITY1 – FLEXIBILITY</i>	-1.241	9.822	1.290	-3.824	1.341	-.963	57	.340
Pair 18	<i>PROBLEM_SOLVING1 - PROBLEM_SOLVING</i>	-1.241	9.587	1.259	-3.762	1.279	-.986	57	.328
Pair 19	<b>GENERAL_MOOD1 - GENERAL_MOOD</b>	-.190	8.347	1.096	-2.384	2.005	-.173	57	.863
Pair 20	<i>OPTIMISM1 – OPTIMISM</i>	-.914	9.818	1.289	-3.495	1.668	-.709	57	.481
Pair 21	<i>HAPPINESS1 – HAPPINESS</i>	.431	7.839	1.029	-1.630	2.492	.419	57	.677

**C-4. T-Test F05 Quinn F05 Paired Samples Statistics Quinn**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Designing and Organizing1	4.157	14	.9154	.2447
	Designing and Organizing	4.814	14	1.0212	.2729
Pair 2	Managing Time and Stress1	4.429	14	1.3986	.3738
	Managing Time and Stress	4.643	14	.9288	.2482
Pair 3	Presenting Ideas1	4.971	14	1.0381	.2774
	Presenting Ideas	5.136	14	.9951	.2659
Pair 4	Managing Change1	4.614	14	.5682	.1519
	Managing Change	5.000	14	.7442	.1989
Pair 5	Developing Employees1	4.600	14	.6421	.1716
	Developing Employees	5.129	14	.7130	.1906
Pair 6	Managing Conflict1	4.514	14	.5641	.1508
	Managing Conflict	5.143	14	.4799	.1283
Pair 7	Managing Core Processes1	4.500	14	.7005	.1872
	Managing Core Processes	5.014	14	.8787	.2348
Pair 8	Managing Across Functions1	3.800	14	.9047	.2418
	Managing Across Functions	4.671	14	1.1166	.2984
Pair 9	Setting Goals and Objectives1	4.943	14	.4669	.1248
	Setting Goals and Objectives	5.471	14	.7907	.2113
Pair 10	Fostering a Productive Work Environment1	4.543	14	.8680	.2320
	Fostering a Productive Work Environment	4.950	14	.7481	.1999
Pair 11	Negotiating Agreement and Commitment1	4.900	14	.7179	.1919
	Negotiating Agreement and Commitment	5.171	14	.6650	.1777
Pair 12	Thinking Creatively1	4.771	14	.7010	.1874
	Thinking Creatively	4.971	14	.8260	.2207
Pair 13	Communicating Effectively1	5.171	14	.5703	.1524
	Communicating Effectively	5.429	14	.6877	.1838

**T-Test F05 Quinn F05 Paired Samples Statistics Quinn (Continued)**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 14	Using Participative Decision Making1	5.186	14	.5503	.1471
	Using Participative Decision Making	5.257	14	1.0952	.2927
Pair 15	Managing Information Overload1	5.200	14	.6226	.1664
	Managing Information Overload	5.086	14	.8511	.2275
Pair 16	Designing Work1	4.700	14	1.0008	.2675
	Designing Work	5.214	14	.8094	.2163
Pair 17	Developing and Communicating a Vision1	4.971	14	.5014	.1340
	Developing and Communicating a Vision	5.271	14	.6999	.1871
Pair 18	Working Productively1	5.486	14	.4622	.1235
	Working Productively	5.500	14	.7348	.1964
Pair 19	Building and Maintaining a Power Base1	5.271	14	.6005	.1605
	Building and Maintaining a Power Base	5.243	14	.7532	.2013
Pair 20	Living with Change1	5.171	14	.5539	.1480
	Living with Change	5.486	14	.5246	.1402
Pair 21	Understanding Self and Others1	5.357	14	.5388	.1440
	Understanding Self and Others	5.757	14	.6333	.1693
Pair 22	Building Teams1	5.300	14	.6214	.1661
	Building Teams	5.457	14	.4863	.1300
Pair 23	Managing Information and Critical Thinking1	4.450	14	.8074	.2158
	Managing Information and Critical Thinking	5.021	14	.9242	.2470
Pair 24	Managing Projects1	5.229	14	.7680	.2053
	Managing Projects	5.686	14	.8254	.2206

**F05 Paired Samples Correlations Quinn**

		N	Correlation	Sig.
Pair 1	Designing and Organizing1& Designing and Organizing	14	.669	.009
Pair 2	Managing Time and Stress1& Managing Time and Stress	14	-.525	.054
Pair 3	Presenting Ideas1& Presenting Ideas	14	.666	.009
Pair 4	Managing Change 1& Managing Change	14	.626	.017
Pair 5	Developing Employees1 & Developing Employees	14	.692	.006
Pair 6	Managing Conflict1 & Managing Conflict	14	.287	.319
Pair 7	Managing Core Processes1 & Managing Core Processes	14	.717	.004
Pair 8	Managing Across Functions1 & Managing Across Functions	14	.661	.010
Pair 9	Setting Goals and Objectives1 & Setting Goals and Objectives	14	.412	.143
Pair 10	Fostering a Productive Work Environment1 & Fostering a Productive Work Environment	14	.577	.031
Pair 11	Negotiating Agreement and Commitment1 & Negotiating Agreement and Commitment	14	.696	.006
Pair 12	Thinking Creatively1 & Thinking Creatively	14	.700	.005
Pair 13	Communicating Effectively1 & Communicating Effectively	14	.567	.034
Pair 14	Using Participative Decision Making1 & Using Participative Decision Making	14	.438	.117
Pair 15	Managing Information Overload1 & Managing Information Overload	14	.575	.032
Pair 16	Designing Work1 & Designing Work	14	.575	.031
Pair 17	Developing and Communicating a Vision1 & Developing and Communicating a Vision	14	.725	.003
Pair 18	Working Productively1 & Working Productively	14	.435	.120
Pair 19	Building and Maintaining a Power Base1 & Building and Maintaining a Power Base	14	.653	.011
Pair 20	Living with Change1 & Living with Change	14	.592	.026
Pair 21	Understanding Self and Others1 & Understanding Self and Others	14	.093	.751
Pair 22	Building Teams1 & Building Teams	14	.112	.703
Pair 23	Managing Information and Critical Thinking1 & Managing Information and Critical Thinking	14	.675	.008
Pair 24	Managing Projects1 & Managing Projects	14	.365	.200

## F05 Paired Samples Test Quinn

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	Upper	Lower			
Pair 1	Designing and Organizing1 - Designing and Organizing	-.6571	.7939	.2122	-1.115	-.1987	-3.097	13	.008
Pair 2	Managing Time and Stress1 - Managing Time and Stress	-.2143	2.0448	.5465	-1.394	.9664	-.392	13	.701
Pair 3	Presenting Ideas1 - Presenting Ideas	-.1643	.8317	.2223	-.6445	.3159	-.739	13	.473
Pair 4	Managing Change1 - Managing Change	-.3857	.5895	.1575	-.7261	-.0454	-2.448	13	.029
Pair 5	Developing Employees1 - Developing Employees	-.5286	.5355	.1431	-.8378	-.2194	-3.693	13	.003
Pair 6	Managing Conflict1 - Managing Conflict	-.6286	.6269	.1675	-.9905	-.2666	-3.752	13	.002
Pair 7	Managing Core Processes1 - Managing Core Processes	-.5143	.6163	.1647	-.8701	-.1585	-3.122	13	.008
Pair 8	Managing Across Functions1 - Managing Across Functions	-.8714	.8543	.2283	-1.364	-.3781	-3.817	13	.002
Pair 9	Setting Goals and Objectives1 - Setting Goals and Objectives	-.5286	.7342	.1962	-.9525	-.1046	-2.694	13	.018
Pair 10	Fostering a Productive Work Environment1 - Fostering a Productive Work Environment	-.4071	.7509	.2007	-.8407	.0264	-2.029	13	.063
Pair 11	Negotiating Agreement and Commitment1 - Negotiating Agreement and Commitment	-.2714	.5413	.1447	-.5839	.0411	-1.876	13	.083
Pair 12	Thinking Creatively1 - Thinking Creatively	-.2000	.6026	.1610	-.5479	.1479	-1.242	13	.236
Pair 13	Communicating Effectively1 - Communicating Effectively	-.2571	.5945	.1589	-.6004	.0861	-1.618	13	.130
Pair 14	Using Participative Decision Making1 - Using Participative Decision Making	-.0714	.9872	.2638	-.6414	.4985	-.271	13	.791
Pair 15	Managing Information Overload1 - Managing Information Overload	.1143	.7091	.1895	-.2952	.5237	.603	13	.557
Pair 16	Designing Work1 - Designing Work	-.5143	.8511	.2275	-1.008	-.0229	-2.261	13	.042
Pair 17	Developing and Communicating a Vision1 - Developing and Communicating a Vision	-.3000	.4820	.1288	-.5783	-.0217	-2.329	13	.037
Pair 18	Working Productively1 - Working Productively	-.0143	.6769	.1809	-.4051	.3766	-.079	13	.938
Pair 19	Building and Maintaining a Power Base1 - Building and Maintaining a Power Base	.0286	.5810	.1553	-.3069	.3640	.184	13	.857

**F05 Paired Samples Test Quinn (Continued)**

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 20	Living with Change1 - Living with Change	-.3143	.4881	.1305	-.5961	-.0325	-2.409	13	.032
Pair 21	Understanding Self and Others1 - Understanding Self and Others	-.4000	.7923	.2117	-.8574	.0574	-1.889	13	.081
Pair 22	Building Teams1 - Building Teams	-.1571	.7449	.1991	-.5873	.2730	-.789	13	.444
Pair 23	Managing Information and Critical Thinking1 - Managing Information and Critical Thinking	-.5714	.7065	.1888	-.9793	-.1635	-3.026	13	.010
Pair 24	Managing Projects1 - Managing Projects	-.4571	.8993	.2404	-.9764	.0621	-1.902	13	.080

**C-5. T-Test S06 Quinn S06 Paired Samples Statistics Quinn**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Designing and Organizing1	4.609	44	.8069	.1216
	Designing and Organizing	5.168	44	.7643	.1152
Pair 2	Managing Time and Stress1	4.841	44	1.1997	.1809
	Managing Time and Stress	5.205	44	1.0248	.1545
Pair 3	Presenting Ideas1	4.948	44	.8293	.1250
	Presenting Ideas	5.286	44	.8881	.1339
Pair 4	Managing Change1	4.559	44	.7466	.1125
	Managing Change	5.123	44	.6864	.1035
Pair 5	Developing Employees1	4.945	44	.6518	.0983
	Developing Employees	5.241	44	.6690	.1009
Pair 6	Managing Conflict1	4.859	44	.6094	.0919
	Managing Conflict	5.227	44	.6200	.0935
Pair 7	Managing Core Processes1	4.736	44	.7304	.1101
	Managing Core Processes	5.150	44	.6876	.1037
Pair 8	Managing Across Functions1	3.991	44	.9750	.1470
	Managing Across Functions	4.895	44	.9083	.1369
Pair 9	Setting Goals and Objectives1	5.118	44	.8999	.1357
	Setting Goals and Objectives	5.400	44	.7166	.1080
Pair 10	Fostering a Productive Work Environment1	4.727	44	.7270	.1096
	Fostering a Productive Work Environment	5.052	44	.7375	.1112
Pair 11	Negotiating Agreement and Commitment1	4.873	44	.6916	.1043
	Negotiating Agreement and Commitment	5.355	44	.6763	.1020
Pair 12	Thinking Creatively1	4.868	44	.7445	.1122
	Thinking Creatively	5.309	44	.7685	.1159
Pair 13	Communicating Effectively1	5.223	44	.7706	.1162
	Communicating Effectively	5.414	44	.6907	.1041



**T-Test S06 Quinn S06 Paired Samples Statistics Quinn (Continued)**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 14	Using Participative Decision Making1	5.211	44	.7509	.1132
	Using Participative Decision Making	5.448	44	.8222	.1240
Pair 15	Managing Information Overload1	5.305	44	.7364	.1110
	Managing Information Overload	5.268	44	.7458	.1124
Pair 16	Designing Work1	5.000	44	.7153	.1078
	Designing Work	5.295	44	.7924	.1195
Pair 17	Developing and Communicating a Vision1	5.255	44	.7274	.1097
	Developing and Communicating a Vision	5.509	44	.7865	.1186
Pair 18	Working Productively1	5.623	44	.7449	.1123
	Working Productively	5.659	44	.8030	.1211
Pair 19	Building and Maintaining a Power Base1	5.177	44	.6194	.0934
	Building and Maintaining a Power Base	5.464	44	.7279	.1097
Pair 20	Living with Change1	5.186	44	.6674	.1006
	Living with Change	5.405	44	.7041	.1062
Pair 21	Understanding Self and Others1	5.755	44	.6128	.0924
	Understanding Self and Others	5.682	44	.6783	.1023
Pair 22	Building Teams1	5.359	44	.6787	.1023
	Building Teams	5.477	44	.7436	.1121
Pair 23	Managing Information and Critical Thinking1	4.839	44	.7002	.1056
	Managing Information and Critical Thinking	5.182	44	.7013	.1057
Pair 24	Managing Projects1	5.477	44	.7284	.1098
	Managing Projects	5.673	44	.8059	.1215

**S06 Paired Samples Correlations Quinn**

		N	Correlation	Sig.
Pair 1	Designing and Organizing1 & Designing and Organizing	44	.438	.003
Pair 2	Managing Time and Stress1 & Managing Time and Stress	44	.330	.029
Pair 3	Presenting Ideas1 & Presenting Ideas	44	.477	.001
Pair 4	Managing Change1 & Managing Change	44	.484	.001
Pair 5	Developing Employees1 & Developing Employees	44	.528	.000
Pair 6	Managing Conflict1 & Managing Conflict	44	.481	.001
Pair 7	Managing Core Processes1 & Managing Core Processes	44	.366	.015
Pair 8	Managing Across Functions1 & Managing Across Functions	44	.479	.001
Pair 9	Setting Goals and Objectives1 & Setting Goals and Objectives	44	.421	.004
Pair 10	Fostering a Productive Work Environment1 & Fostering a Productive Work Environment	44	.412	.005
Pair 11	Negotiating Agreement and Commitment1 & Negotiating Agreement and Commitment	44	.423	.004
Pair 12	Thinking Creatively1 & Thinking Creatively	44	.580	.000
Pair 13	Communicating Effectively1 & Communicating Effectively	44	.634	.000
Pair 14	Using Participative Decision Making1 & Using Participative Decision Making	44	.433	.003
Pair 15	Managing Information Overload1 & Managing Information Overload	44	.527	.000
Pair 16	Designing Work1 & Designing Work	44	.423	.004
Pair 17	Developing and Communicating a Vision1 & Developing and Communicating a Vision	44	.664	.000
Pair 18	Working Productively1 & Working Productively	44	.495	.001
Pair 19	Building and Maintaining a Power Base1 & Building and Maintaining a Power Base	44	.527	.000
Pair 20	Living with Change1 & Living with Change	44	.545	.000
Pair 21	Understanding Self and Others1 & Understanding Self and Others	44	.448	.002
Pair 22	Building Teams1 & Building Teams	44	.550	.000
Pair 23	Managing Information and Critical Thinking1 & Managing Information and Critical Thinking	44	.460	.002
Pair 24	Managing Projects1 & Managing Projects	44	.496	.001

## S06 Paired Samples Test Quinn

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
								Upper	Lower
Pair 1	Designing and Organizing1 - Designing and Organizing	-.5591	.8337	.1257	-.8126	-.3056	-4.448	43	.000
Pair 2	Managing Time and Stress1 - Managing Time and Stress	-.3636	1.2956	.1953	-.7575	.0303	-1.862	43	.069
Pair 3	Presenting Ideas1 - Presenting Ideas	-.3386	.8795	.1326	-.6060	-.0712	-2.554	43	.014
Pair 4	Managing Change1 - Managing Change	-.5636	.7298	.1100	-.7855	-.3418	-5.123	43	.000
Pair 5	Developing Employees1 - Developing Employees	-.2955	.6419	.0968	-.4906	-.1003	-3.053	43	.004
Pair 6	Managing Conflict 1- Managing Conflict	-.3682	.6265	.0944	-.5586	-.1777	-3.898	43	.000
Pair 7	Managing Core Processes1 - Managing Core Processes	-.4136	.7993	.1205	-.6566	-.1706	-3.433	43	.001
Pair 8	Managing Across Functions1 - Managing Across Functions	-.9045	.9630	.1452	-1.1973	-.6118	-6.230	43	.000
Pair 9	Setting Goals and Objectives1 - Setting Goals and Objectives	-.2818	.8832	.1332	-.5504	-.0133	-2.116	43	.040
Pair 10	Fostering a Productive Work Environment1 - Fostering a Productive Work Environment	-.3250	.7939	.1197	-.5664	-.0836	-2.715	43	.009
Pair 11	Negotiating Agreement and Commitment1 - Negotiating Agreement and Commitment	-.4818	.7349	.1108	-.7053	-.2584	-4.349	43	.000
Pair 12	Thinking Creatively1 - Thinking Creatively	-.4409	.6936	.1046	-.6518	-.2300	-4.217	43	.000
Pair 13	Communicating Effectively1 - Communicating Effectively	-.1909	.6294	.0949	-.3823	.0005	-2.012	43	.051
Pair 14	Using Participative Decision Making1 - Using Participative Decision Making	-.2364	.8395	.1266	-.4916	.0189	-1.868	43	.069
Pair 15	Managing Information Overload1 - Managing Information Overload	.0364	.7208	.1087	-.1828	.2555	.335	43	.740
Pair 16	Designing Work1 - Designing Work	-.2955	.8121	.1224	-.5424	-.0486	-2.413	43	.020
Pair 17	Developing and Communicating a Vision1 - Developing and Communicating a Vision	-.2545	.6226	.0939	-.4438	-.0653	-2.712	43	.010

**S06 Paired Samples Test Quinn (Continued)**

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 18	Working Productively1 - Working Productively	-.0364	.7791	.1175	-.2732	.2005	-.310	43	.758
Pair 19	Building and Maintaining a Power Base1 - Building and Maintaining a Power Base	-.2864	.6618	.0998	-.4876	-.0852	-2.870	43	.006
Pair 20	Living with Change1 - Living with Change	-.2182	.6553	.0988	-.4174	-.0189	-2.209	43	.033
Pair 21	Understanding Self and Others1 - Understanding Self and Others	.0727	.6808	.1026	-.1342	.2797	.709	43	.482
Pair 22	Building Teams1 - Building Teams	-.1182	.6770	.1021	-.3240	.0876	-1.158	43	.253
Pair 23	Managing Information and Critical Thinking1 - Managing Information and Critical Thinking	-.3432	.7283	.1098	-.5646	-.1218	-3.126	43	.003
Pair 24	Managing Projects1 - Managing Projects	-.1955	.7734	.1166	-.4306	.0397	-1.676	43	.101

**C-6. T-Test F05 and S06 Combined Quinn    Combined Paired Samples Statistics Quinn**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Designing and Organizing1	4.500	58	.8487	.1114
	Designing and Organizing	5.083	58	.8377	.1100
Pair 2	Managing Time and Stress1	4.74	58	1.250	.164
	Managing Time and Stress	5.07	58	1.024	.134
Pair 3	Presenting Ideas1	4.953	58	.8744	.1148
	Presenting Ideas	5.250	58	.9083	.1193
Pair 4	Managing Change1	4.572	58	.7033	.0924
	Managing Change	5.09	58	.696	.091
Pair 5	Developing Employees1	4.862	58	.6609	.0868
	Developing Employees	5.214	58	.6752	.0887
Pair 6	Managing Conflict1	4.78	58	.612	.080
	Managing Conflict	5.207	58	.5864	.0770
Pair 7	Managing Core Processes1	4.679	58	.7244	.0951
	Managing Core Processes	5.117	58	.7322	.0961
Pair 8	Managing Across Functions1	3.945	58	.9542	.1253
	Managing Across Functions	4.84	58	.957	.126
Pair 9	Setting Goals and Objectives1	5.076	58	.8163	.1072
	Setting Goals and Objectives	5.42	58	.729	.096
Pair 10	Fostering a Productive Work Environment1	4.68	58	.760	.100
	Fostering a Productive Work Environment	5.03	58	.735	.096
Pair 11	Negotiating Agreement and Commitment1	4.879	58	.6917	.0908
	Negotiating Agreement and Commitment	5.31	58	.672	.088
Pair 12	Thinking Creatively1	4.845	58	.7294	.0958
	Thinking Creatively	5.228	58	.7889	.1036
Pair 13	Communicating Effectively1	5.210	58	.7230	.0949
	Communicating Effectively	5.42	58	.684	.090

**T-Test F05 and S06 Combined Quinn Combined Paired Samples Statistics Quinn (Continued)**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 14	Using Participative Decision Making1	5.205	58	.7032	.0923
	Using Participative Decision Making	5.402	58	.8890	.1167
Pair 15	Managing Information Overload1	5.28	58	.707	.093
	Managing Information Overload	5.224	58	.7688	.1009
Pair 16	Designing Work1	4.928	58	.7945	.1043
	Designing Work	5.28	58	.790	.104
Pair 17	Developing and Communicating a Vision1	5.19	58	.687	.090
	Developing and Communicating a Vision	5.45	58	.767	.101
Pair 18	Working Productively1	5.590	58	.6861	.0901
	Working Productively	5.621	58	.7838	.1029
Pair 19	Building and Maintaining a Power Base1	5.200	58	.6110	.0802
	Building and Maintaining a Power Base	5.410	58	.7336	.0963
Pair 20	Living with Change1	5.183	58	.6372	.0837
	Living with Change	5.424	58	.6618	.0869
Pair 21	Understanding Self and Others1	5.659	58	.6156	.0808
	Understanding Self and Others	5.700	58	.6631	.0871
Pair 22	Building Teams1	5.345	58	.6605	.0867
	Building Teams	5.47	58	.686	.090
Pair 23	Managing Information and Critical Thinking1	4.745	58	.7394	.0971
	Managing Information and Critical Thinking	5.143	58	.7554	.0992
Pair 24	Managing Projects1	5.417	58	.7392	.0971
	Managing Projects	5.68	58	.803	.105

**Combined Paired Samples Correlations Quinn**

		N	Correlation	Sig.
Pair 1	Designing and Organizing1 & Designing and Organizing	58	.529	.000
Pair 2	Managing Time and Stress1 & Managing Time and Stress	58	.151	.257
Pair 3	Presenting Ideas1 & Presenting Ideas	58	.530	.000
Pair 4	Managing Change1 & Managing Change	58	.503	.000
Pair 5	Developing Employees1 & Developing Employees	58	.567	.000
Pair 6	Managing Conflict1 & Managing Conflict	58	.446	.000
Pair 7	Managing Core Processes1 & Managing Core Processes	58	.462	.000
Pair 8	Managing Across Functions1 & Managing Across Functions	58	.526	.000
Pair 9	Setting Goals and Objectives1 & Setting Goals and Objectives	58	.399	.002
Pair 10	Fostering a Productive Work Environment1 & Fostering a Productive Work Environment	58	.458	.000
Pair 11	Negotiating Agreement and Commitment1 & Negotiating Agreement and Commitment	58	.482	.000
Pair 12	Thinking Creatively1 & Thinking Creatively	58	.606	.000
Pair 13	Communicating Effectively1 & Communicating Effectively	58	.617	.000
Pair 14	Using Participative Decision Making1 & Using Participative Decision Making	58	.421	.001
Pair 15	Managing Information Overload1 & Managing Information Overload	58	.536	.000
Pair 16	Designing Work1 & Designing Work	58	.465	.000
Pair 17	Developing and Communicating a Vision1 & Developing and Communicating a Vision	58	.678	.000
Pair 18	Working Productively1 & Working Productively	58	.486	.000
Pair 19	Building and Maintaining a Power Base & Building and Maintaining a Power Base	58	.542	.000
Pair 20	Living with Change1 & Living with Change	58	.550	.000
Pair 21	Understanding Self and Others1 & Understanding Self and Others	58	.348	.007
Pair 22	Building Teams1 & Building Teams	58	.480	.000
Pair 23	Managing Information and Critical Thinking1 & Managing Information and Critical Thinking	58	.531	.000
Pair 24	Managing Projects1 & Managing Projects	58	.457	.000

### Combined Paired Samples Test Quinn

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	Designing and Organizing1 - Designing and Organizing	-.5828	.8185	.1075	-.7980	-.3676	-5.423	57	.000
Pair 2	Managing Time and Stress1 - Managing Time and Stress	-.328	1.491	.196	-.720	.065	-1.673	57	.100
Pair 3	Presenting Ideas1 - Presenting Ideas	-.2966	.8643	.1135	-.5238	-.0693	-2.613	57	.011
Pair 4	Managing Change1 - Managing Change	-.5207	.6978	.0916	-.7042	-.3372	-5.683	57	.000
Pair 5	Developing Employees1 - Developing Employees	-.3517	.6216	.0816	-.5152	-.1883	-4.309	57	.000
Pair 6	Managing Conflict1 - Managing Conflict	-.4310	.6311	.0829	-.5970	-.2651	-5.201	57	.000
Pair 7	Managing Core Processes1 - Managing Core Processes	-.4379	.7553	.0992	-.6365	-.2393	-4.416	57	.000
Pair 8	Managing Across Functions1 - Managing Across Functions	-.8966	.9308	.1222	-1.141	-.6518	-7.336	57	.000
Pair 9	Setting Goals and Objectives1 - Setting Goals and Objectives	-.3414	.8502	.1116	-.5649	-.1178	-3.058	57	.003
Pair 10	Fostering a Productive Work Environment1 - Fostering a Productive Work Environment	-.345	.778	.102	-.549	-.140	-3.375	57	.001
Pair 11	Negotiating Agreement and Commitment1 - Negotiating Agreement and Commitment	-.4310	.6946	.0912	-.6137	-.2484	-4.726	57	.000
Pair 12	Thinking Creatively1 - Thinking Creatively	-.3828	.6757	.0887	-.5604	-.2051	-4.314	57	.000
Pair 13	Communicating Effectively1 - Communicating Effectively	-.2069	.6167	.0810	-.3690	-.0447	-2.555	57	.013
Pair 14	Using Participative Decision Making1 - Using Participative Decision Making	-.1966	.8712	.1144	-.4256	.0325	-1.718	57	.091
Pair 15	Managing Information Overload1 - Managing Information Overload	.0552	.7126	.0936	-.1322	.2425	.590	57	.558
Pair 16	Designing Work1 - Designing Work	-.3483	.8196	.1076	-.5638	-.1328	-3.236	57	.002
Pair 17	Developing and Communicating a Vision1 - Developing and Communicating a Vision	-.266	.588	.077	-.420	-.111	-3.439	57	.001



**Combined Paired Samples Test Quinn (Continued)**

		Paired Differences					t	df	Sig. 2-tailed
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 18	Working Productively1 - Working Productively	-.0310	.7500	.0985	-.2282	.1662	-.315	57	.754
Pair 19	Building and Maintaining a Power Base1 - Building and Maintaining a Power Base	-.2103	.6526	.0857	-.3819	-.0388	-2.455	57	.017
Pair 20	Living with Change1 - Living with Change	-.2414	.6165	.0809	-.4035	-.0793	-2.982	57	.004
Pair 21	Understanding Self and Others1 - Understanding Self and Others	-.0414	.7310	.0960	-.2336	.1508	-.431	57	.668
Pair 22	Building Teams1 - Building Teams	-.1276	.6874	.0903	-.3083	.0532	-1.413	57	.163
Pair 23	Managing Information and Critical Thinking1 - Managing Information and Critical Thinking	-.3983	.7237	.0950	-.5886	-.2080	-4.191	57	.000
Pair 24	Managing Projects1 - Managing Projects	-.2586	.8053	.1057	-.4704	-.0469	-2.446	57	.018

## C-7. Summarized EQi Table

EQi 133	F05			S06			F05/S06			
	Mean	T	2-Tail	Mean	T	2-Tail	Mean	T	2-Tail	
Pair 1	<b>TOTAL_EQ1 – TOTAL_EQ</b>	-1.905	-1.206	0.242	-0.595	-0.523	0.604	-1.069	-1.163	0.250
Pair 2	<b>INTRAPERSONAL1 - INTRAPERSONAL</b>	-1.810	-1.021	0.319	-1.730	-1.340	0.189	-1.759	-1.700	0.095
Pair 3	SELF_REGARD1 - SELF_REGARD	-1.048	-0.449	0.659	-1.892	-1.338	0.189	-1.586	-1.294	0.201
Pair 4	EMOTIONAL_SELF_AWARENESS1 - EMOTIONAL_SELF_AWARENESS	-4.381	-2.841	0.010	0.757	0.578	0.567	-1.103	-1.052	0.297
Pair 5	ASSERTIVENESS1 – ASSERTIVENESS	-1.571	-0.701	0.491	-2.676	-1.990	0.054	-2.276	-1.943	0.057
Pair 6	INDEPENDENCE1 – INDEPENDENCE	-1.000	-0.484	0.634	-2.135	-1.593	0.120	-1.724	-1.529	0.132
Pair 7	SELF_ACTUALIZATION1 - SELF_ACTUALIZATION	1.667	0.709	0.486	-1.405	-1.077	0.289	-0.293	-0.245	0.807
Pair 8	<b>INTERPERSONAL1 - INTERPERSONAL</b>	-1.905	-1.256	0.224	0.676	0.559	0.580	-0.259	-0.271	0.787
Pair 9	EMPATHY1 – EMPATHY	-4.905	-3.609	0.002	-0.405	-0.246	0.807	-2.034	-1.715	0.092
Pair 10	SOCIAL_RESPONSIBILITY1 - SOCIAL_RESPONSIBILITY	-0.476	-0.208	0.837	1.595	1.202	0.237	0.845	0.716	0.477
Pair 11	INTERPERSONAL_RELATIONSHIP1 - INTERPERSONAL_RELATIONSHIP	-1.000	-0.583	0.566	-0.189	-0.134	0.895	-0.483	-0.443	0.659
Pair 12	<b>STRESS_MANAGEMENT1 - STRESS_MANAGEMENT</b>	-1.476	-0.974	0.342	0.081	0.073	0.943	-0.483	-0.538	0.593
Pair 13	STRESS_TOLERANCE1 - STRESS_TOLERANCE	-2.810	-1.422	0.170	-3.541	-2.324	0.026	-3.276	-2.737	0.008
Pair 14	IMPULSE_CONTROL1 - IMPULSE_CONTROL	0.143	0.094	0.926	3.216	2.688	0.011	2.103	2.208	0.031
Pair 15	<b>ADAPTABILITY1 – ADAPTABILITY</b>	-3.476	-1.966	0.063	-0.514	-0.412	0.682	-1.586	-1.542	0.128
Pair 16	REALITY_TESTING1 - REALITY_TESTING	-3.714	-1.915	0.070	-0.189	-0.126	0.900	-1.466	-1.224	0.226
Pair 17	FLEXIBILITY1 – FLEXIBILITY	-2.857	-1.097	0.286	-0.324	-0.234	0.816	-1.241	-0.963	0.340
Pair 18	PROBLEM_SOLVING1 - PROBLEM_SOLVING	-2.190	-1.120	0.276	-0.703	-0.427	0.672	-1.241	-0.986	0.328
Pair 19	<b>GENERAL_MOOD1 - GENERAL_MOOD</b>	1.238	0.525	0.606	-1.000	-0.922	0.363	-0.190	-0.173	0.863
Pair 20	OPTIMISM1 – OPTIMISM	-0.952	-0.367	0.717	-0.892	-0.630	0.533	-0.914	-0.709	0.481
Pair 21	HAPPINESS1 – HAPPINESS	2.762	1.208	0.241	-0.892	-0.969	0.339	0.431	0.419	0.677

### Summarized Quinn Table

		F05			S06			F05 and S06 Combined		
		Mean	T	2-Tail	Mean	T	2-Tail	Mean	T	2-Tail
Pair 1	Designing and Organizing1 – Designing and Organizing	-0.657	-3.097	0.008	-0.559	-4.448	0.000	-0.583	-5.423	0.000
Pair 9	Setting Goals and Objectives1 – Setting Goals and Objectives	-0.529	-2.694	0.018	-0.282	-2.116	0.040	-0.341	-3.058	0.003
Pair 3	Presenting Ideas1 – Presenting Ideas	-0.164	-0.739	0.473	-0.339	-2.554	0.014	-0.297	-2.613	0.011
Pair 11	Negotiating Agreement and Commitment1 - Negotiating Agreement and Commitment	-0.271	-1.876	0.083	-0.482	-4.349	0.000	-0.431	-4.726	0.000
Pair 6	Managing Conflict1- Managing Conflict	-0.629	-3.752	0.002	-0.368	-3.898	0.000	-0.431	-5.201	0.000
Pair 14	Using Participative Decision Making1 - Using Participative Decision Making	-0.071	-0.271	0.791	-0.236	-1.868	0.069	-0.197	-1.718	0.091
Pair 8	Managing Across Functions1 - Managing Across Functions	-0.871	-3.817	0.002	-0.905	-6.230	0.000	-0.897	-7.336	0.000
Pair 16	Designing Work1 - Designing Work	-0.514	-2.261	0.042	-0.295	-2.413	0.020	-0.348	-3.236	0.002
Pair 17	Developing and Communicating a Vision1 - Developing and Communicating a Vision	-0.300	-2.329	0.037	-0.255	-2.712	0.010	-0.266	-3.439	0.001
Pair 2	Managing Time and Stress1 – Managing Time and Stress	-0.214	-0.392	0.701	-0.364	-1.862	0.069	-0.328	-1.673	0.100
Pair 19	Building and Maintaining a Power Base1 - Building and Maintaining a Power Base	0.029	0.184	0.857	-0.286	-2.870	0.006	-0.210	-2.455	0.017
Pair 4	Managing Change1 – Managing Change	-0.386	-2.448	0.029	-0.564	-5.123	0.000	-0.521	-5.683	0.000
Pair 22	Building Teams1 - Building Teams	-0.157	-0.789	0.444	-0.118	-1.158	0.253	-0.128	-1.413	0.163
Pair 5	Developing Employees1 – Developing Employees	-0.529	-3.693	0.003	-0.295	-3.053	0.004	-0.352	-4.309	0.000
Pair 24	Managing Projects1 - Managing Projects	-0.457	-1.902	0.080	-0.195	-1.676	0.101	-0.259	-2.446	0.018
Pair 7	Managing Core Processes1 – Managing Core Processes	-0.514	-3.122	0.008	-0.414	-3.433	0.001	-0.438	-4.416	0.000
Pair 10	Fostering a Productive Work Environment1 - Fostering a Productive Work Environment	-0.407	-2.029	0.063	-0.325	-2.715	0.009	-0.345	-3.375	0.001

**Summarized Quinn Table (Continued)**

		F05			S06			F05 and S06 Combined		
		Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail	Mean	<i>T</i>	2-Tail
Pair 18	Working Productively1 – Working Productively	-0.014	-0.079	0.938	-0.036	-0.310	0.758	-0.031	-0.315	0.754
Pair 12	Thinking Creatively1 – Thinking Creatively	-0.200	-1.242	0.236	-0.441	-4.217	0.000	-0.383	-4.314	0.000
Pair 20	Living with Change1 - Living with Change	-0.314	-2.409	0.032	-0.218	-2.209	0.033	-0.241	-2.982	0.004
Pair 13	Communicating Effectively1 - Communicating Effectively	-0.257	-1.618	0.130	-0.191	-2.012	0.051	-0.207	-2.555	0.013
Pair 21	Understanding Self and Others1 - Understanding Self and Others	-0.400	-1.889	0.081	0.073	0.709	0.482	-0.041	-0.431	0.668
Pair 15	Managing Information Overload1 - Managing Information Overload	0.114	0.603	0.557	0.036	0.335	0.740	0.055	0.590	0.558
Pair 23	Managing Information and Critical Thinking1 - Managing Information and Critical Thinking	-0.571	-3.026	0.010	-0.343	-3.126	0.003	-0.398	-4.191	0.000

**C-8. Reliability for Hypothesis 1 (Assertiveness and Stress Tolerance) Fall05****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	21	100.0
	Excluded( a)	0	.0
	Total	21	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.822	.826	4

**Item Statistics**

	Mean	Std. Deviation	N
ASSERTIVENESS1	103.90	13.003	21
STRESS_TOLERANCE1	101.19	9.983	21
ASSERTIVENESS	105.48	10.230	21
STRESS_TOLERANCE	104.00	10.242	21

### C-9. Reliability for Hypothesis 1 (*Assertiveness and Stress Tolerance*) Spring06

**Scale: ALL VARIABLES**

#### Case Processing Summary

		N	%
Cases	Valid	37	100.0
	Excluded( a)	0	.0
	Total	37	100.0

a Listwise deletion based on all variables in the procedure.

#### Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.841	.845	4

#### Item Statistics

	Mean	Std. Deviation	N
ASSERTIVENESS1	101.76	10.560	37
STRESS_TOLERANCE1	101.68	12.157	37
ASSERTIVENESS	104.43	11.179	37
STRESS_TOLERANCE	105.22	9.578	37

**C-10. Reliability for Hypothesis 1 (*Assertiveness and Stress Tolerance*) Fall05 and Spring06 Combined**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	58	100.0
	Excluded(a)	0	.0
	Total	58	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.834	4

**Item Statistics**

	Mean	Std. Deviation	N
ASSERTIVENESS1	102.53	11.439	58
STRESS_TOLERANCE1	101.50	11.330	58
ASSERTIVENESS	104.81	10.766	58
STRESS_TOLERANCE	104.78	9.751	58

**C-11. Reliability for Hypothesis 2 (Leadership and Communication) Fall05 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	14	100.0
	Excluded(a)	0	.0
	Total	14	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.888	.904	6

**Item Statistics**

	Mean	Std. Deviation	N
Designing and Organizing1	4.157	.9154	14
Setting Goals and Objectives1	4.943	.4669	14
Developing and Communicating a Vision1	4.971	.5014	14
Designing and Organizing	4.814	1.0212	14
Setting Goals and Objectives	5.471	.7907	14
Developing and Communicating a Vision	5.271	.6999	14



**C-12. Reliability for Hypothesis 2 (Leadership and Communication) Fall2005 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	14	100.0
	Excluded(a)	0	.0
	Total	14	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.763	.754	6

**Item Statistics**

	Mean	Std. Deviation	N
Developing Employees1	4.600	.6421	14
Communicating Effectively1	5.171	.5703	14
Understanding Self and Others1	5.357	.5388	14
Developing Employees Communicating Effectively	5.129	.7130	14
Understanding Self and Others	5.429	.6877	14
	5.757	.6333	14

**C-13. Reliability for Hypothesis 2 (Leadership and Communication) Spring06 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	44	100.0
	Excluded(a)	0	.0
	Total	44	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.880	.883	6

**Item Statistics**

	Mean	Std. Deviation	N
Designing and Organizing1	4.609	.8069	44
Setting Goals and Objectives1	5.118	.8999	44
Developing and Communicating a Vision1	5.255	.7274	44
Designing and Organizing	5.168	.7643	44
Setting Goals and Objectives	5.400	.7166	44
Developing and Communicating a Vision	5.509	.7865	44

**C-14. Reliability for Hypothesis 2 (Leadership and Communication) for Spring06 Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	44	100.0
	Excluded(a)	0	.0
	Total	44	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.808	.807	6

**Item Statistics**

	Mean	Std. Deviation	N
Developing Employees1	4.945	.6518	44
Communicating Effectively1	5.223	.7706	44
Understanding Self and Others1	5.755	.6128	44
Developing Employees Communicating Effectively	5.241	.6690	44
Understanding Self and Others	5.414	.6907	44
	5.682	.6783	44

**C-15. Reliability for Hypothesis 2 (Leadership and Communication) Fall05 and Spring06 Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	58	100.0
	Excluded(a)	0	.0
	Total	58	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.883	.886	6

**Item Statistics**

	Mean	Std. Deviation	N
Designing and Organizing1	4.500	.8487	58
Setting Goals and Objectives1	5.076	.8163	58
Developing and Communicating a Vision1	5.186	.6866	58
Designing and Organizing	5.083	.8377	58
Setting Goals and Objectives	5.417	.7286	58
Developing and Communicating a Vision	5.452	.7674	58

**C-16. Reliability for Hypothesis 2 (Leadership and Communication) Fall05 and Spring06 Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	58	100.0
	Excluded(a)	0	.0
	Total	58	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.797	.796	6

**Item Statistics**

	Mean	Std. Deviation	N
Developing Employees1	4.862	.6609	58
Communicating Effectively1	5.210	.7230	58
Understanding Self and Others1	5.659	.6156	58
Developing Employees	5.214	.6752	58
Communicating Effectively	5.417	.6839	58
Understanding Self and Others	5.700	.6631	58

**C-17. Reliability Hypothesis 3 (Adaptability and Management) Fall05 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	14	100.0
	Excluded(a)	0	.0
	Total	14	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.874	6

**Item Statistics**

	Mean	Std. Deviation	N
Managing Change1	4.614	.5682	14
Thinking Creatively1	4.771	.7010	14
Living with Change1	5.171	.5539	14
Managing Change	5.000	.7442	14
Thinking Creatively	4.971	.8260	14
Living with Change	5.486	.5246	14

**C-18. Reliability for Hypothesis 3 (Adaptability and Management) Fall05 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	14	100.0
	Excluded(a)	0	.0
	Total	14	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.863	.864	6

**Item Statistics**

	Mean	Std. Deviation	N
Managing Across Functions1	3.800	.9047	14
Designing Work1	4.700	1.0008	14
Managing Projects1	5.229	.7680	14
Managing Across Functions	4.671	1.1166	14
Designing Work	5.214	.8094	14
Managing Projects	5.686	.8254	14

**C-19. Reliability for Hypothesis 3 (Adaptability and Management) for Spring06 Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	44	100.0
	Excluded(a)	0	.0
	Total	44	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.901	.902	6

**Item Statistics**

	Mean	Std. Deviation	N
Managing Change1	4.559	.7466	44
Thinking Creatively1	4.868	.7445	44
Living with Change1	5.186	.6674	44
Managing Change	5.123	.6864	44
Thinking Creatively	5.309	.7685	44
Living with Change	5.405	.7041	44



**C-20. Reliability for Hypothesis 3 (Adaptability and Management) Spring06 Quinn****Scale: ALL VARIABLES****Case Processing Summary**

		N	%
Cases	Valid	44	100.0
	Excluded(a)	0	.0
	Total	44	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.818	.823	6

**Item Statistics**

	Mean	Std. Deviation	N
Managing Across Functions1	3.991	.9750	44
Designing Work1	5.000	.7153	44
Managing Projects1	5.477	.7284	44
Managing Across Functions	4.895	.9083	44
Designing Work	5.295	.7924	44
Managing Projects	5.673	.8059	44

**C-21. Reliability for Hypothesis 3 (Adaptability and Management) Fall05 and Spring 06 Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	58	100.0
	Excluded(a)	0	.0
	Total	58	100.0

a Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.894	.895	6

**Item Statistics**

	Mean	Std. Deviation	N
Managing Change1	4.572	.7033	58
Thinking Creatively1	4.845	.7294	58
Living with Change1	5.183	.6372	58
Managing Change	5.093	.6961	58
Thinking Creatively	5.228	.7889	58
Living with Change	5.424	.6618	58

**C-22. Reliability for Hypothesis 3 (Adaptability and Management) Fall05 and Spring06  
Quinn**

**Scale: ALL VARIABLES**

**Case Processing Summary**

		N	%
Cases	Valid	58	100.0
	Excluded(a)	0	.0
	Total	58	100.0

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

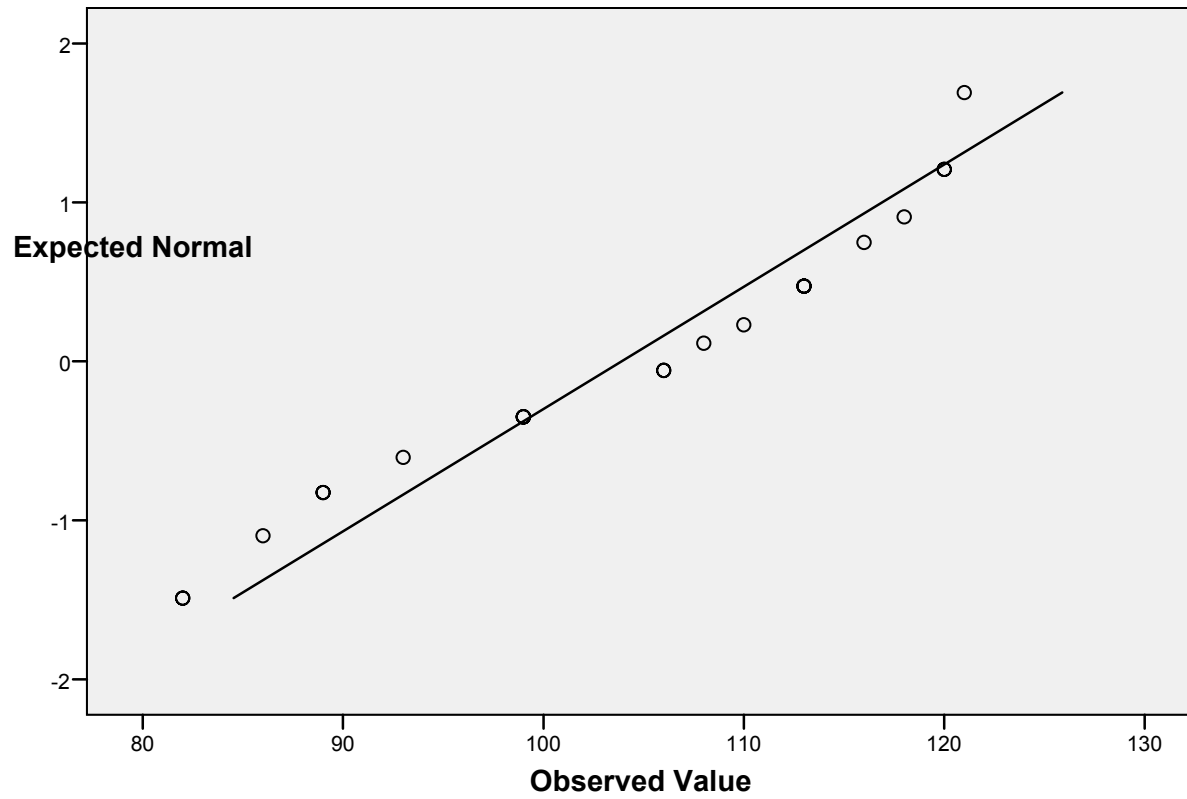
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.834	6

**Item Statistics**

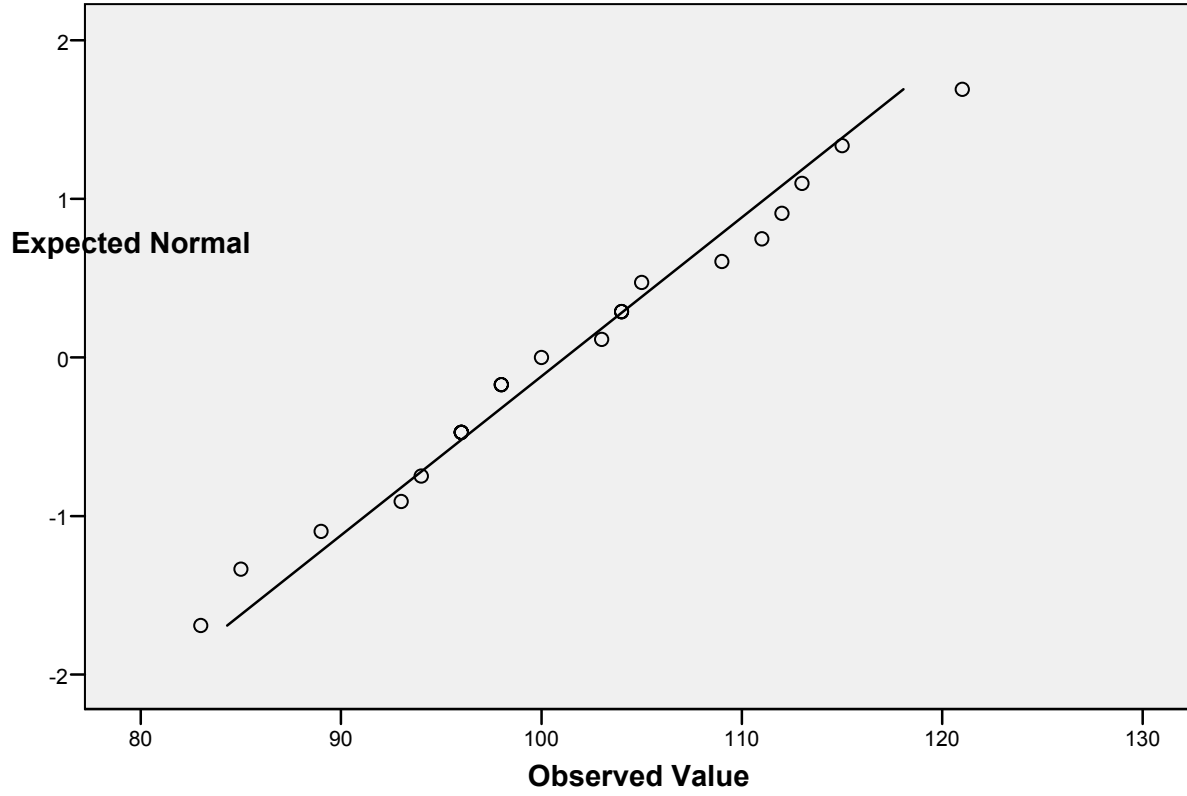
	Mean	Std. Deviation	N
Managing Across Functions1	3.945	.9542	58
Designing Work1	4.928	.7945	58
Managing Projects1	5.417	.7392	58
Managing Across Functions	4.841	.9572	58
Designing Work	5.276	.7901	58
Managing Projects	5.676	.8034	58

**APPENDIX D. NORMALITY PLOTS**

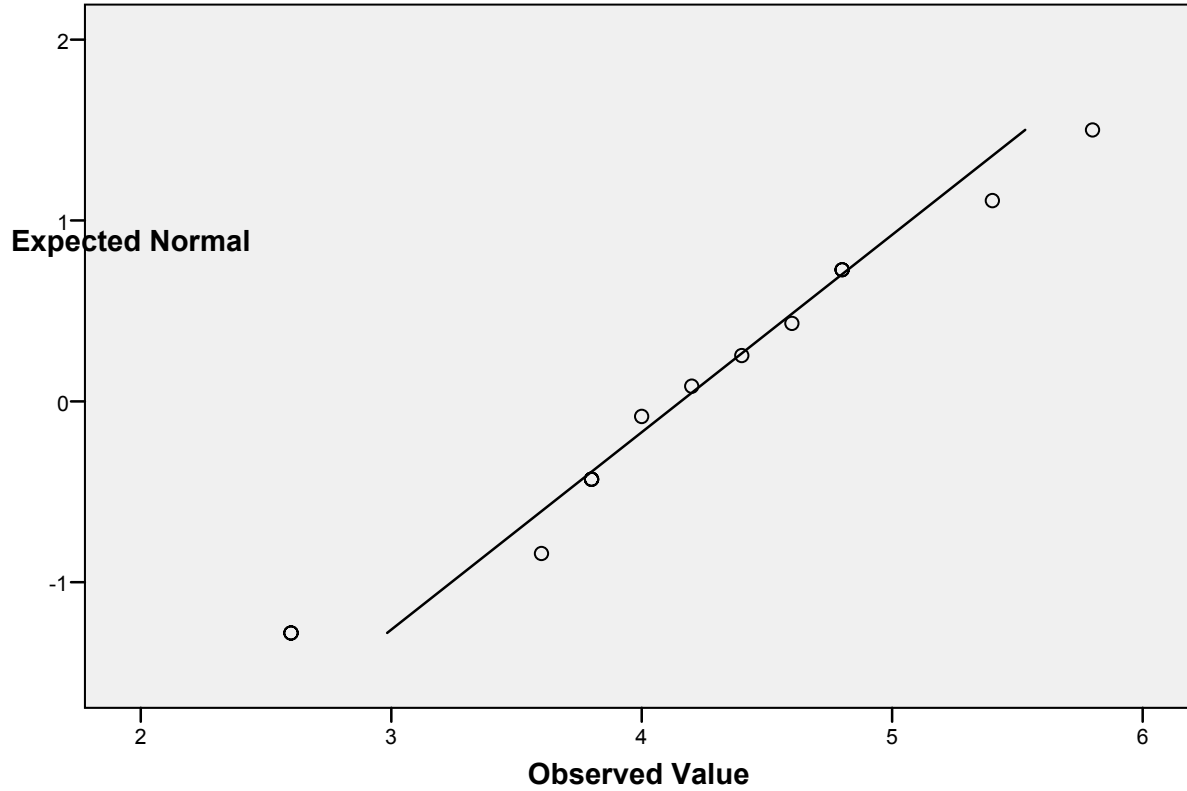
**F05 Normal Q-Q Plot of ASSERTIVENESS1**



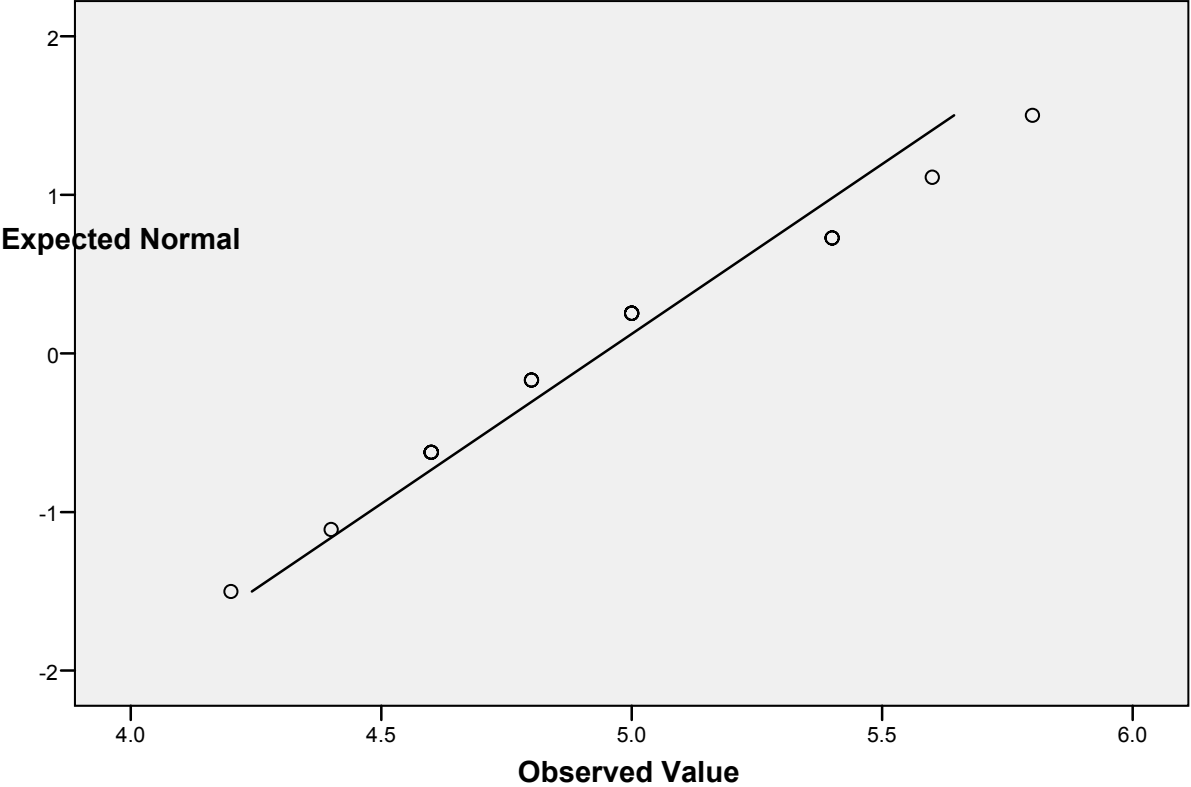
F05 Normal Q-Q Plot of STRESS\_TOLERANCE1



**F05 Normal Q-Q Plot of Designing and Organizing1**

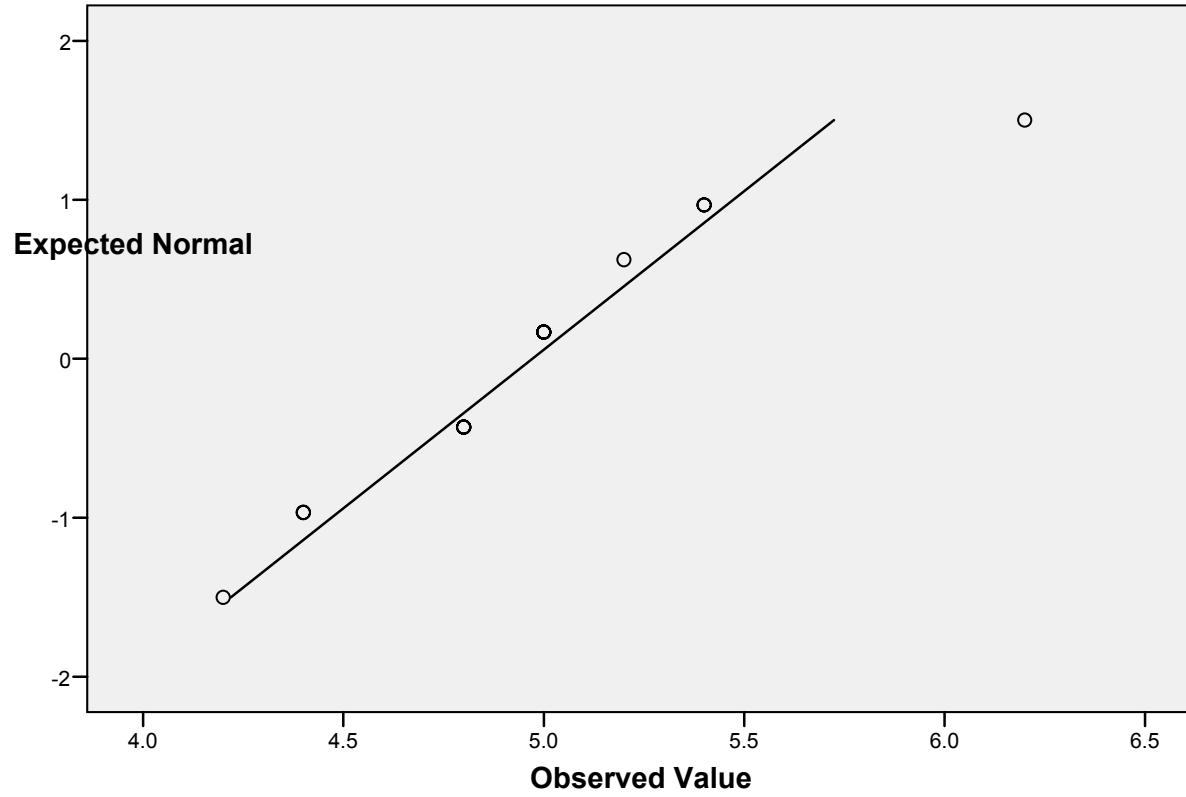


F05 Normal Q-Q Plot of Setting Goals and Objectives1





**F05 Normal Q-Q Plot of Developing and Communicating a Vision1**



**REFERENCES**

- Accreditation Board for Engineering and Technology, Inc. (ABET). (1998). *Engineering criteria 2000*, ABET, Baltimore, Md.
- Adamchick, A. (2004). How do your people rate? *FMI Quarterly*, 2, 99-107.
- Agresti, A., & Finlay, B. (1997). *Statistical methods for the social sciences* (3<sup>rd</sup> Ed.). Upper Saddle River, NJ: Prentice Hall.
- Ashkanasy, N. M., & Daus, C. S. (2005). Rumors of the death of emotional intelligence in organizational behavior are vastly exaggerated. *Journal of Organizational Behavior*, 26, 441-452.
- Babbie, E. (2001). *The practice of social research* (9<sup>th</sup> ed.). Belmont, CA: Wadsworth, Inc.
- Badger, W., Wiezel, A., & Bopp (2007). Leadership education and training Leadership skills truly make a difference, *43<sup>rd</sup> Annual International Conference of the Associated Schools of Construction*, April 1-4, Flagstaff, AZ.
- Bar-On, R. (2005). *EQi Bar-On Emotional Quotient Inventory Technical Manual*, 4<sup>th</sup> Ed., Multi-Health Systems Inc., Toronto, Canada
- Bernold, L. E. (2004). The creative students lack the skills to succeed in engineering education. *ASCE 2004 specialty conference on leadership and management in construction* (323-329). Hilton Head, SC.
- Bernold, L. E. (2007). Teaching evaluations for construction engineering and management: opportunity to move us. Forward. *ASCE Journal of Construction Engineering and Management*, 133(2), 146-156.
- Bernold, L. E., Spurlin, J. E., & Anson, C. M. (2007). Understanding our students: A longitudinal-study of success and failure in engineering with implications for increased retention. *Journal of Engineering Education*, 96(3), 263-274.
- Bishop, J. C. (1996). Civil engineering education: A reality check. *Journal of Management in Engineering*, 12(6), 26-27.
- Bloom, L. R. (1998). *Under the sign of hope, Feminist methodology and narrative interpretation*, Albany: State University of New York, PressBrow.
- Bluedorn, A. C. (1980). Cutting the Gordian knot: A critique of the effectiveness tradition in organizational research, *Sociology and Social Research*, 64, 477-496.

- Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom*. ASHE-ERIC Higher Education Report No. 1. Washington, DC: George Washington University, School of Education and Human Development.
- Bresciani, M. J., Zelna, C. L., & Anderson, J. A. (2004). *Assessing student learning and development: A handbook for practitioners* (3<sup>rd</sup> Ed.). Washington, DC: National Association of Student Personnel Administrators (NASPA).
- Brown, H. (2004). From emotional quotient to success of construction organizations operations: Project-based learning and successful intelligence case study: World Trade Center. *2004 Specialty Conference on Leadership and Management in Construction*, ASCE, Hilton Head, SC., 173-179.
- Cameron, K., (1981). Construct space and subjectivity problems in organizational effectiveness. *Public Productivity Review*, 5, 105-106.
- Campbell, J. P. (1997). *On the nature of organizational effectiveness: New perspectives on organizational effectiveness*. San Francisco: Jossey-Bass.
- Cano, J. L., Lidon, I., Rebollar, R., Roman, P., & Saenz, J. M. (2006). Student groups solving real-life projects. A case study of experimental learning. *International Journal of Engineering Education*, 22(6), 1252-1260.
- Caudron, S. (1999). The hard case for soft skills. *Workforce*, 78, 60-64.
- Carr, P G., & de la Garza, J. M., Vorster, M. C. (2002, October). Relationship between personality traits and performance for engineering and architectural professionals providing design services. *Journal of Management in Engineering*, 158-166.
- Chinowsky, P. (2002). Integrating management breath in civil engineering education. *Journal of Professional Issues in Engineering Education and Practice*, 128(3), 138-143.
- Cohen, A. S. (1987). Instructional alignment: Searching for a magic bullet. *Educational Researcher*, 16(8), 16-20.
- Coll, R.K., & Zegwaard, K. E. (2006). Perceptions of desirable graduate competencies for science and technology of new graduates. *Research in Science & Technological Education*, 24(1), 29-58.
- Conte, J. M. (2005). A review and critique of emotional intelligence measures. *Journal of Organizational Behavior*, 26, 433-440.
- Cooper, R. B., & Quinn, R. E (1993). Implications of the competing values framework for management information systems. *Human Relations Management*, 32(1), 175-201.

- Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2<sup>nd</sup> ed.). Beverly Hills, CA: Sage Publications.
- Daus, C. S., & Ashkanasy, N. M. (2005). The case of ability-based model of emotional intelligence in organizational behavior. *Journal of Organizational Behavior*, 26, 453-466.
- Davies, H. A., & Csette, J., & Poon, L. K. (1999). Employer's expectations of the performance of construction graduates. *International Journal of Engineering Education*, 15(3), 191-198.
- Denison, D. R., Hooijberg, R., & Quinn, R. E. (1995). Paradox and performance: Toward a theory of behavior complexity in managerial leadership. *Organizational Science*, 6(5), 524-540.
- Densten, I. L., & Gray, J. H. (2001). Leadership development and reflection: What is the connection. *International Journal of Educational Management*, 15(3), 119-124.
- Dickmann, M. H., & Stanford-Blair, N. (2002). *Connecting leadership to the brain*. Thousand Oaks, CA: Corwin Press, Inc.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (2<sup>nd</sup> ed.). New York: Wiley & Sons, Inc.
- Farr, J. V., & Merino, D. N. (2002). Educating entry-level engineers: Are broad-based business/managerial skills a key to sustaining the U.S. innovation-based economy? *International Journal of Education*, 19(2), 252-259.
- Gardner, H. (1993) *Frames of mind: The theory of multiple intelligences*, New York: Basic Books.
- Gilleard, J., & Gilleard, J. (2002). Developing cross-cultural communication skills. *Journal of Professional Issues in Engineering Education and Practice*, 128(4), 187-200.
- Goleman, D. (1999, May 10). Engineers need emotional IQ. *Engineering News Record*, p. 167.
- Goleman, D. (1995). *Emotional intelligence: Why it may matter more than IQ*, New York: Bantam Books.
- Goleman, D. (1998). *Working with emotional intelligence*. New York: Bantam Books.
- Gushgari, S. K., Francis, P. A., & Saklou, J. H. (1997). Skills critical to long-term profitability of engineering firms. *Journal of Management in Engineering*, 13(2), 46-56.

- Harfield, T., Panko, M., Davies, K., & Kenley, R. (2007). Toward a learning-styles profile of construction students: Results from New Zealand. *Journal of Construction Education and Research*, 3(3), 143-158.
- Helmreich, R. L. (1984). Cockpit management attitudes. *Human Factors*, 26(5), 583-589.
- Hessen, C. (2000). FMI's 2000 review of engineering and architectural trends. *FMI*, 2(2), 1.
- Jaeger, A. J. (2003). Job competencies and curriculum: An inquiry into emotional intelligence in graduate professional education. *Research in Higher Education*, 44(6), 615-639.
- Johnson, H. M., & Singh, A. (1998, July/August). The personality of civil engineers. *Journal of Management in Engineering*, 14(4), 45-56.
- Kalliath, T. J., Bluedorn, A. C., & Gillespie, D. F. (1999). A confirmatory factor analysis of the competing values instrument. *Educational and Psychological Measurement*, 59(1), 143-158.
- Kelley, R. & Capalan, J. (1993). How Bell Labs creates star performers. *Harvard Business Review*, 71(4), 128-139.
- Kemper, C. L. (1999). EQ vs. IQ. *Communication World*, 16, 15-19.
- Kichuk, S., & Wiesner, W. H. (1997). The big five personality factors and team performance: Implications for selecting product design teams. *Journal of Engineering and Technical Management*, 14, 95-221.
- Kim, J.-O., & Mueller, C. W. (1978). *Introduction to factor analysis* Beverly Hills, CA: Sage Publications, Inc.
- Klinger, W. A. (1956, January). Construction education: Industry leader proposes 5-year college curriculum. *The Constructor*.
- Kumar, S., & Hsiao, J. K. (2007). Engineers learn "soft skills the hard way": Planting a seed of leadership in engineering classes. *Leadership and Management in Engineering*, 7(1), 18-23.
- Leydens, J. A., Moskal, B. M., & Pavelich, M., J. (2004, January). Qualitative methods used in the assessment of engineering education. *Journal of Engineering Education*, 93(1), 65-71.
- Lamancusa, J., Zayas, J., Soyster, A., Morell, L., & Jorgensen, J. (2008). The learning factory: Industry-partnered active learning. *Journal of Engineering Education*, 97(1), 5-11.

- Locke, E. A. (2005). Why emotional intelligence is an invalid concept. *Journal of Organizational Behavior*, 26(5), 425-431.
- Lopez, M. L. (2005). The art of interpreting the Bar-On EQi. *MHS Certification Workshop*. August, Minneapolis, MN.
- McGraw, D. (2004, Summer). Expanding the mind. *Prism*, 31-36.
- McKeachie, W. J. (2002). *McKeachie's teaching tips: Strategies, research, and theory for college and university teachers*. Boston: Houghton Mifflin Co.
- Merriam, S. B., & Associates. (2002). *Qualitative research in practice: Examples for discussion and analysis*. San Francisco: Jossey-Bass.
- Myers, I. B., McCaulley, M. H., Quenk, N. L., & Hammer, A. L. (2003). *MBTI manual* (3<sup>rd</sup> ed.). Mountain View, CA: CPP, Inc.
- Neuman, L. W. (2000). *Social research methods: Qualitative and quantitative approaches* (4<sup>th</sup> ed.). Needham Heights, MA: Pearson Education Company.
- Norman, G., & Schmidt, H. (2000). Effectiveness of problem-based learning curricula: Theory, practice and paper darts. *Medical Education*, 34, 721-728.
- Nunnally, J. C. (1978). *Psychometric theory* (2<sup>nd</sup> ed.). New York: McGraw-Hill.
- Nyman, M. (2005, September). Why "soft skills" really matter to engineers. *Civil Engineering News*, p. 28.
- Odusami, K. T. (2002). Perceptions of construction professionals concerning important skills of effective project leaders. *Journal of Management in Engineering*, 18(2).
- Ofori-Dankwa, J., & Julian, S. D. (2001). Complexifying organizational theory: Illustrations using time research. *The Academy of Management Review*, 26(3), 415-430.
- Paparone, C. R. (2003). Applying the competing value framework to study organizational subcultures and system-wide planning efforts in a military university. Harrisburg: Pennsylvania State University, Public Administration.
- Perruccio, M. (2004). The war for talent. *FMI Quarterly*, 4, 107-115.
- Prince, M. J. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223-231.
- Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, 95,(2) 123-138.

- Prince, M. J., Felder, R., & Brent, R. (2007). Does faculty research improve undergraduate teaching? An analysis of existing and potential synergies. *Journal of Engineering Education*, 96(4), 283-294.
- Ribeiro, L. Camargo, R., Mizukami, M., & Nicoletti, G. (2005). Student assessment of a problem based learning experiment in civil engineering education. *Journal of Professional Issues in Engineering Education and Practice*, ASCE, 131(1), 13-18.
- Rohrbaugh, J. (1981). Operationalizing the competing values approach: Measuring performance in the employment service. *Public Productivity Review*, 5(2), 141-159.
- Quinn, R. E., & Faerman, S. R., Thompson, M. P., & McGrath, M. R. (2003). *Becoming a master manager: A competency framework* (3<sup>rd</sup> ed.). New York: Wiley.
- Quinn, R. E., & Rohrbaugh, J. (1981). A competing values approach to organizational effectiveness. *Public Productivity Review*, 5(2), 122-140.
- Quinn, R. E., & Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organizational analysis. *Management Science*, 29(3), 363-377.
- Quinn, R. E., & Spreitzer, G. M. (1991). The psychometrics of the competing values cultures instrument and the analysis of the impact of organizational culture on the quality of life. *Research in organizational change and development*, 5, 155-142.
- Quinn, R. E., (2004). *Building the bridge as you walk on it*. San Francisco: Jossey-Bass.
- Resnick, L. B. (1987). Learning in school and out: *The 1987 Presidential address*, 16(9), 13-20, 54.
- Roesset, J. M., & Yao, J. T. (2002). State of the art of structural engineering. *Journal of Structural Engineering*, 128(8), 131-141.
- Roselli, R. J., & Brophy, S. P. (2006). Effectiveness of challenged-based instruction in biomechanics. *Journal of Engineering Education*, 95(4), 311-324.
- Rothenberg, A. (1979). *The emerging Goddess: The creative process in science and other fields*. University of Chicago Press.
- Russell, J. S. (2003). *Perspectives in civil engineering*. Reston, VA: American Society of Civil Engineers.
- Russell, J. S., & Yao, J. T. P. (1996). "Consensus! Students need more management education" *Journal of Management in Engineering*, 12(6), 17-24.

- Russell, J. S., Stouffer, W. B., & Walesh, S. G. (2004). Changing civil engineering education: A system view. *Specialty Conference on Leadership and Management in Construction*, ASCE, Hilton Head, SC., 211-224.
- Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality*, 9(3), 185-211.
- Schoppman, G. (2006). FMI 2006 Project Management Survey. *FMI*.
- Schutt, R. K. (2001). *Investigating the social world: The process and practice of research* (3<sup>rd</sup> ed.). Thousand Oaks, CA: Sage.
- Shuman, L. J., Besterfield-Sacre, M., & McGourty, J. (2005). The ABET “professional skills”: Can they be taught? Can they be assessed? *Journal of Engineering Education*, 94(1), 41-55.
- Singh, A. (2002). Behavioral perceptions of design and construction engineers. *Engineering Construction and Architectural Management*, 9(2), 66-80.
- Sinha, K. C., & Bullock, D., Hendrickson, C. T., Levison, H. S., & Lyles, R. W. et al. (2002). Development of transportation engineering research, education, and practice in a changing civil engineering world. *Journal of Transportation Engineering*, 128(4), 193-205.
- Songer, A. D., Walker, B., Beliveau, Y. (2004). General contractor emotional intelligence in the construction industry. *Specialty Conference on Leadership and Management in Construction*, ASCE, Hilton Head, SC., 1-12.
- Spector, P. E. (2005). Introduction: Emotional intelligence. *Journal of Organizational Behavior*, 26, 409-410.
- Steers, R. M. (1975). Problems in the measurement of organizational effectiveness. *Administrative Scientific Quarterly*, 20, 546-558.
- Sprenger, M. (1999) *Learning & memory: The brain in action*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
- Stein, S. J., & Book, H. E. (2000). *The EQ edge: Emotional intelligence and your success*. Toronto, CAN: Multi-Health Systems, Inc.
- Sternberg, R. J. (1985). *Beyond I.Q.* New York: Cambridge University Press.
- Thamhain, H. J. (1992). *Engineering management: Managing effectively in technology-based organizations* (1<sup>st</sup> Ed.). New York: Wiley.
- Thomas, S. R., Tucker, R. L., & Kelly, W. R. (1998). Critical communications variables. *Journal of Construction Engineering and Management*, 124(1), 58-66.



- Turns, J., Eliot, M., Neal, R., & Linse, A. (2007). Investigating the teaching concerns of engineering educators. *Journal of Engineering Education*, 96(4), 295-308.
- Walesh, S. (1996). Can we spare a paradigm? *Journal of Management in Engineering*, 12(6), 27-29.
- Weiner, B. (1992). *Human motivation: Metaphors, theories, and research* Thousand Oaks, CA: Sage.
- Wellington, P., Thomas, I., Powell, I., & Clarke, B. (2002). Authentic assessment applied to engineering and business undergraduate consulting teams. *International Journal of Engineering Education*, 18(2), 168-179
- Wilson, K. (2007). *FMI 2006-2007 U.S. construction industry training report*. FMI.
- Yeo, R. K. (2005). Problem-based learning in tertiary education: teaching old “dogs” new tricks? *Education and Training*, 47(7), 506-518.
- Zolin, R., Fruchter, R., & Levitt, R. (2003). Realism and control: Problem-based learning programs as a data source for work-related research. *International Journal of Engineering Education*, 19(6), 788-798.

## ACKNOWLEDGMENTS

I am grateful to my major co-major professors, Drs. Russell Walters and Loren Zachary, for the opportunity to conduct research on improving classroom teaching and learning in construction engineering. I am also thankful of my committee members Drs. Larry Ebbers, Edward Jaselskis, Charles Jahren, and Mack Shelley, for their support of this research. Additional appreciation goes to Dr. Besser, who initially introduced me to the power of mix design, and Dr. Saunders who performed the additional qualitative peer review. Further acknowledgement is extended to all the Iowa State administrators who had the initial vision, leadership, and courage to improve engineering education.

It has been a rewarding experience to teach construction engineering using real-world practices. Through the years, students have shown me their gratitude by becoming successful leaders on the job as managers, team leaders, presidents, and owners of companies.

Special thanks to the students who participate daily in my classes. They continually make me realize that teaching is a noble profession and that the very good teacher cares not only about what is learned but also how learning best occurs.

Finally, I am indebted to my entire capstone family. They traveled this long journey with me in so many important ways.