**VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**

# A Theoretical Framework for Implementing Soft Skills in Construction Education Utilizing Design for Six Sigma

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**Key Words:** Soft skills, Construction, Education, Design for Six Sigma, Taxonomy, Curriculum, Framework

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**Abstract:** Recently, in the United States and worldwide, the excellence of soft skills competencies among entry-level employees has become a priority task of education. Construction employers are encountering a significant gap between the soft skills possessed by the entry level construction graduates and those needed by construction employers, thereby becoming a major challenge for both industry and academia. This research proposed a soft skills instructional curriculum that aims to increase cultivation of soft skills among construction students by exploring the soft skills needed in the construction industry and improving the soft skills educational tools in construction schools. Moreover, the research will answer broad questions such as: Which soft skills matter the most? What is the magnitude of the soft skills gap? And, how do students get help to cultivate soft skills?

A stakeholders-driven exploratory embedded mixed-design research approach was adopted utilizing Design for Six Sigma (DFSS) framework. The DFSS framework is comprised of five phases: Define, Measure, Analyze, Design, and Verify. Therefore, the research defined and organized the construction related soft skills into 12 clusters. The 12 clusters were used to benchmark the soft skills clusters performance among construction graduates using a survey instrument. Simultaneously, the research identified 40 instructional strategies and then defined the relationships between each soft skills cluster and the 40 instructional strategies using structured interviews with experts from academia. The survey data was used to measure the gap in each skill cluster using Gap Score Method and prioritize them into four sets: Critical Clusters, Ideal Clusters, Lowest Priority Clusters, and Least Clusters. Then, the research implemented four Quality Function Deployment matrices using the data acquired from the survey, structured interviews, and the analysis. The four matrices were used to develop a soft skills instructional curriculum comprised of four instructional models in which each soft skills clusters set was matched with the effective instructional strategies. Finally, the research added the values of Gap Score and the value of Sigma Level for each cluster to the proposed curriculum to be used as indicators to measure the future changes in the industry's soft skills need. The proposed curriculum was shared with four experts from academia and they verified the results.

It is expected that the research results will pave the road for launching any future soft skills initiatives in construction education. They revealed significant evidence of the existence of soft skills gaps among construction graduates and proposed an effective soft skills instructional curriculum. It is expected that through utilizing this curriculum, the teaching activities of construction will improve and broaden the soft skills taught in the classrooms to correlate with those needed in the marketplace. Consequently, this will help bridge the gaps between construction graduates and their employers and ultimately facilitate the recruitment of construction graduates.

**Key Words:** Soft skills, Construction, Education, Design for Six Sigma, Taxonomy, Curriculum, Framework

# A Theoretical Framework for Implementing Soft Skills in Construction Education Utilizing Design For Six Sigma

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**Abstract**: The United States construction industry is currently undergoing continuous changes as a response to advanced technology, competitiveness, and globalization. All create notable challenges for the industry and academia to cope with these changes. Therefore, doing a much better job to equip the construction graduates with the needed marketplace skills became a strategic choice for construction academia to satisfy the industry needs.

Existing literature shows evidence of a soft skills gap among construction graduates. After a normative analysis for the gap and the possible remedies, the author proposed utilizing Design for Six Sigma (DFSS) framework to aid in understanding the problem and to also optimize an effective soft skills instruction curriculum that can ultimately increase the soft skills cultivation among construction graduates. The proposed DFSS framework has five phases: Define Phase, Measure Phase, Analyze Phase, Design Phase, and Verify Phase (DMADV).

In the Define Phase, a soft skills taxonomy of 12 clusters and a list of curriculum instructional strategies were developed. The 12 clusters were used in the Measure Phase to benchmark the existing state of the soft skills clusters among construction graduates utilizing an industry survey. Consequently, experts from academia determined the relationship between the taxonomy clusters and the curriculum instructional strategies list. In the Analyze Phase, the gap score was calculated for all clusters in the taxonomy, and the taxonomy skills were prioritized into four sets using quadrant analysis. The quality function deployment (QFD) tool was used four times to calculate the relative weight of the instructional strategy in each soft skills set. In the Design Phase, four instructional curriculum models were proposed. Finally, in the Verify Phase, the research results were shared with four experts in soft skills education from academia to verify the proposed soft skills instructional curriculum and to get their feedback on the quality of the results.

It is hoped that the study results will help academia optimize the effective soft skills instructional curriculum model and to better implement soft skills in construction curricula.

# Dedication

"*Growing older is mandatory. Growing up is optional.*"

**Chili Davis**

To my greatest teachers, my father ‘Khalaf’ and my mother ‘Fairouz’,

To my wife ‘Buran’ and my kids ‘Bishre’, ‘Yasmeen’ and ‘Omar’,

To my sisters and brothers ‘Mahasen’, ‘Momena’, ‘Maram’, ‘Aysha’, ‘Ola’, ‘Yusra’, ‘Qasem’, ‘Ali’ and ‘Omran’

To my dear mentors ‘Natheer’ and ‘Walid’,

To all of my friends,

This work would not have been accomplished without your constant support.

To you all, I dedicate my dissertation.

*Jaser*

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*Jaser*

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# CHAPTER 1: INTRODUCTION

### 1.1 Background:

The distinguished quality of the United States' (US) higher education is widely acknowledged internationally. A large number of graduates of US higher education institutions continue to play a major role in the scientific and technological development worldwide. Therefore, the excellence of the workforce is a critical asset in any human capital plan in the US. To sustain that, governmental policies start focusing on higher education competitiveness. Two strands have emerged toward that goal. The first one focuses on education and general skills, whilst the second one focuses on the investigation of competency in the employment context. The notion of workplace-related skills was raised in the early 1990s, when the Secretary of Labor appointed the Commission on Achieving Necessary Skills (SCANS) (Huitt 1999) to determine the skills that graduates need to succeed in the high performance workplace, as well as to help educators understand how curriculum and instruction must change to correlate those skills among students. The road toward solving the employability problem goes ever on.

In the US construction industry, under pressure from many forces, such as: globalization, financing, environmental impact, competition, change under technical forces (i.e. technology, new materials and processes), and the rise of customer expectations (Marshall 1994; Mead 1993), developing the right skills in the schools' graduates became a priority of both industry and academia. They believe that developing graduates' skills is a keystone of the industry success. More specifically, many research publications started arguing that soft skills, or the lack of soft skills, are a major construction challenge (Cooke-Davies 2002; Darnell 2005; De Wit 1988; Geoghegan and Dulewicz 2008; Gido and Clements 2012).

### 1.2 What are Soft Skills?

Gilman (1989) defines the word "skill" alone as "the ability to use one's knowledge effectively and readily in execution or performance;" it is "a learned power of doing something competently." Oxford dictionary (Press 1989) identifies 'soft skills' as "personal attributes that enable someone to interact effectively and harmoniously with other people." In current literature, there is a lack of consensus on the definition of soft skills among scholars. Snell et al. (2002) defines soft skills as "*skills, abilities, and traits that pertain to personality, attitude and behavior rather than formal or technical knowledge*". Snell's definition can comprise the majority of other scholarly definitions, e.g. Non-technical Skills (Walters and Sirotiak 2011), Non-cognitive

Skills (Sirotiak 2008), Non-academic Skills (Selamat et al. 2013), Employability Skills (McGrath-Champ et al. 2010), Lifelong Skills (Toor and Ofori 2008), Generic Skills (Kruss et al. 2012), Essential Skills (Othman 2014), Key Competencies (Ahn et al. 2012), Transferable Skills (Ayarkwa et al. 2012), Enterprise Skills (Merrifield 2013), and General Capabilities (Gann and Salter 2001). The definition of "soft skills" can include not only skills and competences relevant to employment, but also those that are related to the community such as: Citizenship, Ethics, and Diversity (Hall and Jaggar 1997).

In this research, we define "soft skills" as the needed ability and traits that are often used to describe the non-technical skills. Soft skills include but are not limited to: communication skills, critical thinking and problem solving, team working, conflict resolution, adaptability, flexibility, long life learning, cultural awareness, etc.

### 1.3 Why Soft Skills?

There is a broad consensus amongst construction academia and industry that construction school graduates must be ready to enter the workforce. They should be equipped with technical (Hard) and soft skills that enable them to apply their knowledge directly in the work setting. However, there is a consensus in most reports and literature regarding construction employability that employers are complaining about the low level of skills of newly hired construction graduates, and specifically soft skills (Ahn et al. 2012; Group 2004; Huitt 1999; Institute for a Competitive Workforce 2012; Representatives 2012). Employers argue that the lack in soft skills competences affect work performance, output, and efficiency.

Like all business organizations, construction firms are continuously applying changes to their business practices. For instance, they are replacing current traditional construction delivery methods with new innovative ones, using new managerial concepts, and using flatter organizational forms with a wide line of authority among employees (Jackson and Hancock 2010). Moreover, four generations of employees' composition: traditionalists, baby-boomers, generation X, and generation Y/Millennials, are now interacting side by side in the workplace while they have different values, experiences, and styles (Kehrli and Sopp 2006). All of that is leading to misunderstandings and frustrations among employers due to the lack of soft skills. Managing construction projects successfully requires a mixture of soft skills and technical skills. Lack of soft skills among construction graduates in entry-level positions is one of the most

serious threats to the construction industry's future. It could affect schedules, costs, and ultimately critically delay projects and put at risk the economic benefits of those projects.

The construction industry is also rapidly shifting towards becoming a service industry competing in a global market place. This requires new types of skills among employees, such as diversity, cultural knowledge and awareness, and virtual team communication and collaboration (Playfoot and Hall 2009). In parallel with that, a changing of attitudes to the purpose of undergraduate education is starting to emerge under the pressure of industry, government, and accreditation institutes. For all of these reasons, soft skill competences among construction graduates need to be developed to match the industry needs and the construction program needs to take the lead in creating a foundation of these skills among their graduates (Green et al. 2009).

### 1.4 The Research Problem: Soft Skills Gap among Construction Graduates

Construction management literature has more focus on the technical side of construction knowledge whilst it somehow ignores the non-technical part. Pant and Baroudi (2008) argue that the focus of construction management literature has always been on the hard skills, shifting 'soft skills' from the forefront to the background. Both Russell et al. (1997) and Ceran and Dorman (1995) argue that construction managers must supplement their traditional functions with other non-engineering knowledge and skills to meet today's professional demands for which they become responsible. While there is a development in thinking about the nature of 'soft skills' and its role in construction projects, such an approach has not changed significantly. Many researchers, like (Gillard, 2009), (Beard, 2005), (Bourne, 2003), (Carbone & Gholston, 2004), and (Pant and Baroudi 2008) investigate the 'soft skills' side of project management as a knowledge gap without tackling the roots of that problem and/or propose holistic remedies.

In the construction industry, the soft skills gap is partially a knowledge gap and also a supply/demand problem. Andrews and Higson (2008) argue that there is an increasingly wide gap between the skills and capabilities of graduates and the requirements and demands of the work environment. Many employers have expressed dissatisfaction with their newly hired graduates, especially with respect to soft skills. Other employers state that projects could fail due to the lack of soft skills among project staff rather than because they were technically incompetent (Alpern 1997), (Russell et al. 1997), (Shtub et al. 1994).

Construction literature has lengthy discussions on how to prepare students with soft skills and proposes ways to implement it in the curriculum (Achor and Achor 2000; Alter and Koontz 1996; Berryman et al. 2004; Bhattacharjee and Ghosh 2013; Chinowsky and Vanegas 1996; Cho et al. 2014; Fiori and Songer 2009; Grosskopf 2004; Hauck 1998; Holland and Feigenbaum 1998; Jackson 2005; Kiisk 1998; Mills and Beliveau 1999; Mulligan and Knutson 2000; Nassar 2002; Riley et al. 2008; Robson et al. 1996; Senior 1998; Stier 1997). They clearly highlight the existence of a soft skills gap between the construction industry's needs and the level of soft skills competency in graduates from construction programs.

All industry and competitiveness reports indicate that there is a significant and growing skills gap in the United States (Institute for a Competitive Workforce 2012). Employers see big gaps in both hard and soft skills. In those reports, soft skills gain more focus and the gap is highlighted quantitatively. For instance, late 2012, the Association for Talent Development (ASTD) conducted a survey for its members to explore the skills gap issue in their firms (Parker 2012). Prior to the survey, ASTD defined the skills gap as a "*significant gap between an organization's current abilities and the skills it needs to achieve its goals. It is the point at which an organization can no longer grow or remain competitive because it cannot fill critical jobs with employees who have the right knowledge, skills, and abilities*." The survey respondents were from different industries with different backgrounds. The outcomes of the survey indicate that the majority of the respondents, 84%, mention a skills gap in their firms. Likewise, 54% of the respondents rank "leadership and executive level" skills at the top of the skills gap that their organization is experiencing. Given that leadership and executive level skills are soft skills, the survey highlighted more soft skills as the highest areas for skills gaps in the respondents organizations, like: managerial and supervisory skills, communication/interpersonal skills, profession- or industry-specific skills and customer service skills, whilst skills like: basic skills, technical/it/systems skills and sales skills received lower ranking.

Another quantitative indicator for the soft skills gap was evident in a 2012 survey conducted throughout North Carolina by Workforce Development Boards of North Carolina (Representatives 2012) to employers in all 100 counties including construction employers. The aim of the survey was to identify the skills gaps and the recruiting challenges, determine the current skills' needs, and find out which skills were critical among newly hired employees. The survey found that 58.9% of the respondents had indicated that Communication and Interpersonal

Skills represented a primary gap in the workplace, while 46.8% of them indicated a gap in Critical and Analytical Thinking, and 45.4% admitted a gap in Problem Solving.

**Research Problem:** There is evidence of a significant gap between the construction industry's needs for soft skills and the preparedness of construction graduates (Soft Skills Gap).

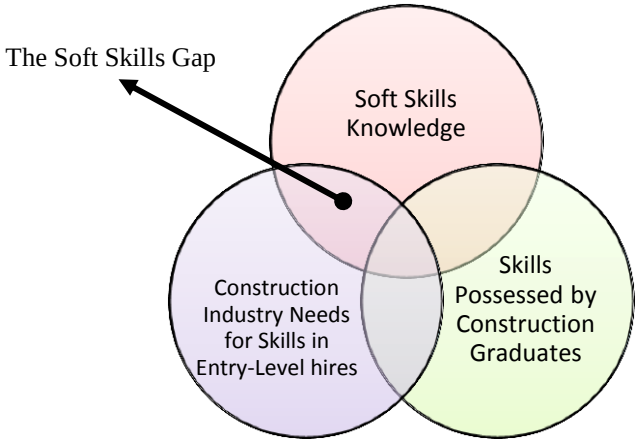



**Figure 1.1: Soft Skills Gap**

## 1.5 Factors Contributing to the Soft Skills Gap:

The research defined five factors that contributed to the soft skills gap (Further discussion in Chapter 2). In combination or isolation, those factors contribute to the continued existence of the soft skills gap and the failure of current remedial approaches. The factors are:

- The existing content, definition, interpretations, and approaches for soft skills used among construction educators and employers are not clear.
- Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap.
- Current solutions to bridge the soft skills gap are unstructured.
- The existing construction education curriculum cannot sufficiently support students to cultivate soft skills competencies to match the industry's needs. There is a lag between the construction curriculum updates as it compares continuous changes in the industry.
- Soft skills are regarded as less important than technical skills by construction higher education accreditation bodies.

## 1.6 Research Goal and Objectives:

**The overall purpose of this research is to increase the cultivation of 'soft skills' among construction schools' graduates.** The research hypothesized that developing new learning innovations to increase the soft skills level among construction graduates would be the key solution to reducing the soft skills gap. The research proposed the innovation in the form of an effective soft skills instruction curriculum. The research proposes a methodology for developing a soft skills curriculum that provides a stronger foundation for addressing the soft skills gap in construction education. The research sets four objectives as follows:

**#1:** Developing and proposing a theoretical framework for designing an effective soft skills curriculum.

**#2:** Developing a soft skills taxonomy and using it to benchmark the existing state of the soft skills gap among construction graduates.

**#3:** Prioritizing the soft skills taxonomy based on the construction industry need.

**#4:** Proposing and verifying an effective soft skills instructional curriculum for construction education.

Also, the research answered three questions, which are:

- What is the magnitude of the soft skills gap?
- Which soft skills matter the most to the industry? And, what should be taught to the construction students?
- How do students get help to better cultivate soft skills? And, how should these skills be integrated within a construction curriculum?

## 1.7 Research Limitations:

This study was limited to the following:

1. The scope of this study was unified by the structural curriculum theory which defines the worthwhile subject matter selection method and justification for the process. Also, it explains how to organize the meaningful knowledge within a curriculum framework so that it transforms that knowledge into rigorous and relevant quality learning activities and instructional standards that will help educators better prepare construction students for future industry career opportunities. Therefore, the research outcomes didn't suggest a detailed syllabus. The research only addressed the effective soft skills instructional guidelines that will ultimately increase the soft skills cultivation among the construction graduates.
2. The research used a non-probability convenient sampling method for the structured interviews and to solicit and capture feedback from experts. It used stratified random sampling for the industry survey; thus, the results generalization was limited to the research sample only.
3. The research relied on Dr. Akao's model and used only the construction industry as an evaluator for the soft skills outcomes of construction schools (discussed in Chapter 3). The research did not interact with construction students, assuming that the literature review covers their learning needs.
4. The research did not call for international data input. While some information acquired from international literature was used to strengthen the research, the study focused on the soft skills gap within the United States' construction industry. Scholars from other countries should collect different and additional data to define and address the soft skills gap specific for their geographical location.
5. The study did not implement and test the proposed instructional curriculum. This was out of the research scope.

## 1.8 Research and Contribution:

This research has several important contributions to the body of knowledge. The research proposed five new coherent contributions: First, it proposed and demonstrated the use of Design for Six Sigma as a useful decision aid framework to implement soft skills in construction curriculum. Second, it proposed and used a novel soft skills taxonomy as a first step toward a soft skills standardization. Third, it benchmarked the existing status of soft skills levels among construction graduates. Fourth, it proposed and verified a soft skills instructional curriculum for soft skills education. Finally, this wok contributes greatly to the application of research method domain.

## 1.9 Dissertation Structure:

This dissertation is organized into nine chapters as follows:

**Chapter 1:** Provides an introduction and background to the research, highlights the research problems, and sets the research goals and objectives. It summarizes the research assumptions, stages, and methodology.

**Chapter 2:** Develops the knowledge base of the research by reviewing the relevant literature. It provides a detailed review of related articles from construction management, construction education, quality higher-education, soft skills, non-technical skills, curriculum theories, curriculum design approaches, and curriculum components.

**Chapter 3:** Focuses on the research methodology and developing theoretical framework.

**Chapter 4:** Discusses the Define Phase with focus on the process of extracting, organizing, and clustering the soft skills based on the literature discovery concept, as well as defining the soft skills curriculum components and the components options that will be tested.

**Chapter 5:** Discusses the Evaluate Phase with focus on the design and implementation of the survey and the structured interview design.

**Chapter 6:** Discusses the Analyze Phase of the theoretical framework.

**Chapter 7:** Discusses the Design Phase of the theoretical framework, and maps the soft skills curriculum framework.

**Chapter 8:** Discusses the Verify Phase and the process of sharing the research findings with construction academia experts, as well as documents their feedback.

**Chapter 9:** Draws up the research conclusions and discusses the benefit of the research. Finally, provides ideas for future research investigations.

# CHAPTER 2: LITERATURE REVIW

## 2.1 Introduction:

The aim of this chapter was to reveal the major causes of the soft skills gap among construction graduates in entry-level positions. An exploratory literature-based discovery, mixed with a research approach involving a detailed literature review and critical examination of scholarly construction publications, industry reports, and accreditation bodies' manuals was conducted. The analysis of that literature supported by the experiential knowledge of the researchers revealed five major causes that, in combination or isolation, contributed to the soft skills gap.

Literature-based discovery (Chen et al. 2011) method and root-cause analysis method are used to develop this chapter. Literature-based discovery refers to the use of academic publications to find new relationships between existing knowledge, while root-cause analysis is a method of problem solving used to clearly understand what is causing a problem. The research involves a detailed literature review and critical examination of three major information sources: scholarly construction publications, accreditation manuals and reports, and industry reports. The data is extracted using a qualitative approach, and then a mixed method approach is used to analyze the data. The literature review defines the soft skills gap. The literature-based discovery approach combined with the root-cause technique helps in defining five causes that contribute to the existence of the gap. Then, the researchers proposed criteria that they will use as a starting point to conduct a normative analysis to the methodological options, and at the end of the research to assess the inference quality of the research. Figure 2.1 conceptualizes the Literature review methodology.

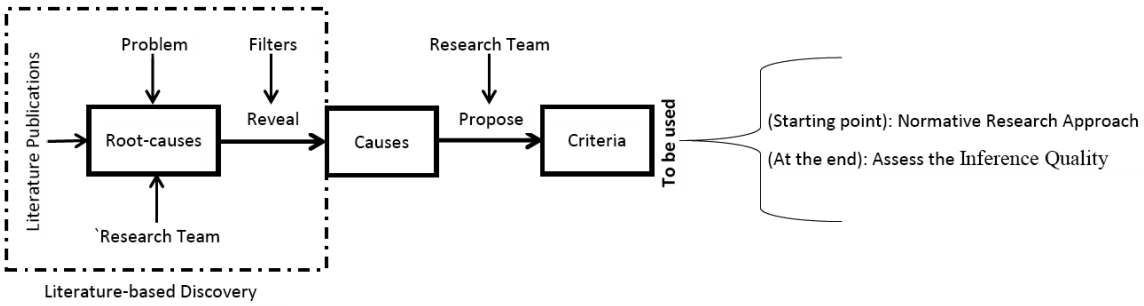



**Figure 2.1: The Literature review methodology**

## 2.2 Causes Contributing to the Soft Skills Gap

Applying the literature-based discovery and Roots' Cause Analysis methods to extract and analyze information from scholarly construction-related papers and reports resulted in defining five reasons for the soft skills gap. In combination or isolation, those reasons contribute to the continued existence of the soft skills gap and the failure of current remedial approaches. The factors are:

- The existing content, definition, interpretations, and approaches for soft skills used among construction educators and employers are not clear.
- Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap.
- Current solutions to bridge the soft skills gap are unstructured.
- The existing construction education curriculum cannot sufficiently support students to cultivate soft skills competencies to match the industry's needs. There is a lag between the construction curriculum updates as it compares continuous changes in the industry.
- Soft skills are regarded as less important than technical skills by construction higher education accreditation bodies.

**The existing content, definition, interpretations, and approaches for soft skills used among construction educators and employers are not clear:**

An acceptable standardization for construction industry-related soft skills classification has not yet been identified. For all stakeholders, it is a big challenge figuring out how to identify soft skills. The majority of scholarly studies on industry-related soft skills are using overwhelmingly ambiguous expressions and terms to represent soft skills. This renders a different interpretation for them by employers in different settings (Male et al. 2009). This also results in a mix up and confusion for understanding the skills gap content, whether it is non-technical skills (Pant and Baroudi 2008), employability skills (Andrews and Higson 2008), interpersonal skills (Egbu 1999), critical skills, emotional intelligence (Darnell 2005; Goleman 2006), (Goleman 2006), or soft skills (Hager et al. 2000; Muzio et al. 2007; Pant and Baroudi 2008).

There is little to no standardization of soft skills' needs data among construction academia and industry. This contributes to an information gap on soft skills' requirements for current and

future construction jobs' needs and makes it difficult for construction academia to design appropriate curriculum to address those needs.

**Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap:**

The dominant view is that construction schools are unable to offer the needed soft skills without any clarifications or precise dimensions to what is really needed (Group 2004). There are no consensuses on standard or good tools to assess students' soft skills level during education and/or immediately after graduation.

Construction academia scholars need to better understand the employers' soft skills needs in order to prepare graduates with the needed soft skills abilities. Recent researches conducted by construction academia are often based on examining abstract and non-measurable phenomena (Representatives 2012). Alternatively, different measurement indicators are used by other stakeholders. Employers prefer to use opinion surveys to measure the soft skills gap, while economists and policy makers use educational achievement as indicators. This has contributed to more dispersion for the measurements and ultimately for the remedies in academia.

While this could be due to the challenges to quantify the soft skills cultivation, it is unlikely that they will address the soft skills gap and develop appropriate remedies without an objective soft skills measurement or benchmarking tool or methodology. Tackling the gap will rely on highly subjective and possibly misleading methodologies unless we use standardized and measurable methods.

**Current solutions to bridge the soft skills gap are unstructured:**

The construction academia is working towards bridging the soft skills gap. However, remedial efforts based in part on educators' personal judgments and in part on some cursory and scattered researches are not enough. The United States has no cohesive national strategy focused on skills or particularly soft skills education (Institute for a Competitive Workforce 2012). However, there are scattered efforts toward this goal. In the construction literature, there are numerous examples of publication that proposing specific alignments for construction education such as: "*Developing Effective Teams*" (Achor 2000); "*Curriculum Development And Continuing Education In Project Management For The Specialty Subcontracting Industry*" (Alter and

Koontz 1996); "*Distance Education With Internet 2 Audio/Video Technology*" (Berryman et al. 2004); "*Combining Practice And Theory In Construction Education Curricula*" (Chinowsky and Vanegas 1996); "*Enhancing Construction Education: Implementing Habitat For Humanity Projects As Service-Learning For Construction Materials*" (Cho et al. 2014); "*Enhancing Construction Education With Contextual Service Learning*" (Fiori and Songer 2009); "*Teaching Methods Improvement Using Industry Focus Groups: A Case Study In Construction Financing*" (Grosskopf 2004); "*Construction Management Curriculum Reform And Integration With A Broader Discipline: A Case Study*" (Hauck 1998); "*Design-Build Education At Associated Schools Of Construction Undergraduate Programs*" (Jackson 2005); "*Vertically integrating a capstone experience: A Case Study for a New Strategy*" (Mills and Beliveau 1999); "*Simulation Gaming In Construction: ER, The Equipment Replacement Game*" (Nassar 2002); "*Embedding Leadership Development In Construction Engineering And Management Education*" (Riley et al. 2008); "*Infusing Practical Components Into Construction Education*" (Senior 1998) and many others. These examples could be valuable if standardized, yet there is an absence of notable progress toward applied efforts in construction practice. The researchers are still debating a central, unclear problem without consensus or answers to critical questions, such as: How do we embed soft skills in the curriculum? What is the best delivery method? How do we assess students' soft skills level and how do we assess them after graduation? How can we benefit from collaboration with industry? How can we share the best practices between schools? How can we improve our students' usefulness and cultivation from those efforts after graduation? These findings and unanswered questions signify that the construction programs curricula are not currently satisfying the industry's needs (Bilbo et al. 2000).

**The existing construction education curriculum cannot sufficiently support students to cultivate soft skills competencies to match the industry's needs. There is a lag between the construction curriculum updates as it compares continuous changes in the industry:**

Construction Management and Building Construction are relatively new disciplines in academia (Ciesielski 2000). The first formal construction courses can be traced back to the 1920s (Dietz and Litle 1976). Massachusetts Institute of Technology, Union University, and Yale University developed courses in construction that focused on technical processes and technology without any management content (McDaniel 2010). By the 1940s, the educators designed construction to

meet the demand for federal government projects and representatives of the building industry (Gunderson et al. 2002). Since that time, construction procurement was dominated by a single delivery design / bid / build (DBB) (Miller et al. 2000). Construction educators developed the construction curriculum to satisfy industry needs which were based on DBB delivery methods. For that, the curricula of construction programs are influenced by the DBB traditional contracting system (Riggs 1988).

Established curriculum of construction schools serve the needs of the industry with more technical knowledge compared with non-technical knowledge (Pant and Baroudi 2008). The changes in business practices and job roles have influenced the increased demand for soft skills by industry and gradually shifted their expectation of construction graduates' abilities. The construction education fails to view the employer as the customer (Institute for a Competitive Workforce 2012). Traditionally, Higher-Education has served two primary customers equally: the individual and the employers. Past publications strongly argue that Higher-Education needs to change the focus from serving individuals to serving employers. However, constructing education sustains using the old traditional curriculum frameworks with minimal or slow changes to address the new challenges for the industry. This produces a lag between construction school graduates' abilities and the construction industry's expectation.

**Soft skills are regarded as less important than technical skills by construction higher education accreditation bodies:**

The American Council for Construction Education (ACCE) and the Accreditation Board for Engineering and Technology (ABET) are the default accreditation institutes for construction schools in the US. Reviewing the current accreditation criteria for both ACCE and ABET indicate the lack of recognition for soft skills as a needed critical outcome for construction schools.

Reviewing the recent ACCE standards show that they require a stand-alone course for three soft skills: oral communication (and/or oral presentation), ethics, and human behavior. The standards also ask to incorporate/ integrate few other soft skills in the curriculum. However, soft skills such as: Effective Meetings skills, Conflict Resolution skills, Negotiation skills, Stress Management skills, and many others are not addressed. Similarly, requirements of soft skills by ABET

standards are lacking. Neither ACCE nor ABET provides a clear tool or methodology to implement the proposed soft skills set or how to audit them.

When comparing ACCE and ABET standards with other accreditation standards for other degrees it becomes evident that others put more emphasis on soft skills. The Association of MBAs (AMBAs) and the European Quality Improvement System (EQUIS) incorporate a larger number of soft skills. For example, AMBA's MBA focuses on both personal and interpersonal skills. It includes interaction and communication skills as well. EQUIS includes self-criticism, coping with complexity, self-awareness, critical thinking, teamwork, communication, interpersonal skills, and leadership.

While it is difficult to teach or measure soft skills, they are proving increasingly valuable in the construction industry. Construction accreditation standards have recently begun promoting and requiring the inclusion of soft skills in the curriculum once they recognized their impact on improving the breadth of knowledge of the graduates and in response to the increasing demand of the construction industry.

### 2.3 Summary:

For success in the workplace, construction industry employers need qualified entry-level graduates who possess needed soft skills coupled with their technical skills. There is a soft skills gap among construction school graduates. The soft skills gap is a result of various factors that contribute to the problem. There is a lack of consensus, clear vision, standardization, and common language on the soft skills gap between industry and academia. The researchers propose criteria that can be used to conduct a normative analysis for the possible methodological approaches to tackle the soft skills gap. These criteria are as follows:

- Developing the foundations of soft skills among graduates is the construction academia's responsibility. Therefore, alignment is needed for the construction schools' curricula.
- Standardizing the soft skills and using them all to design the solution.
- Clearly organizing the industry and academia input in developing the remedies.
- Prioritizing the soft skills based on the construction industry's needs.
- Benchmarking the existing state of soft skills among construction graduates and setting future development goals.

- Having a continuous development component so that it keeps monitoring the soft skills status and developing the solution based on up-to-date data from industry.

The research used the proposed criteria to define the best methodological approach to tackle the soft skills gap among construction graduates using a normative analysis. A decision aid model that produces a reliable holistic soft skills curriculum for construction education and offers a continuous collaboration system between industry and academia to ensure the increase of soft skills cultivation among construction graduates, and ultimately reduce the soft skills gap, was developed. Chapter 3 will highlight the proposed framework and will discuss it in further details.

# CHAPER 3: RESEARCH METHODOLOGY

## 3.1 Introduction:

In the first two chapters, the soft skills gap among construction graduates was defined as "the research problem". Analysis of the gap problem revealed five factors that contributed to the existence of the gap. To reduce the gap, construction education was challenged to implement new learning innovations that aim to increase the soft skills cultivation among their graduates so that future generations would overcome this gap. In line with that argument, this research defines a theoretical framework that can be used to implement soft skills in construction education.

The aim of this chapter is to describe the proposed theoretical framework and explain the methods used in its design. The chapter begins with an overall description of the theoretical framework, followed by the research design strategy, the research philosophical assumptions, and developing the theoretical framework. The chapter concludes with the data collection quality plan.

## 3.2 The Theoretical Framework:

Similar to the products designed in a manufacturing organization, this theoretical framework was used as a decision aid framework that helped in designing reliable holistic soft skills curriculum models to implement soft skills in construction education. It offered a continuous collaboration system between the industry and academia.

Design for Six Sigma (DFSS) was identified as a skeleton for the development of the theoretical framework. The framework was tested in a pilot project and updated. The pilot project (also referred to as pilot study or pilot experiment) refers to the use of the framework as planned for the intended research, yet on a smaller scale (Antony and Preece 2002; Bryman 2012). The pilot project strategy was used in the research to reduce the errors and to test the feasibility of the framework in reality.

The theoretical framework is comprised of five phases: Define, Measure, Analyze, Design, and Verify (DMADV), and was a mix of qualitative and quantitative research methods. Figure 3.1 conceptualizes the theoretical framework proposed. Table 3.1 presents the theoretical framework, its objectives, outputs, and outlines the research methods and tools that were used in each phase. Table 3.2 presents the theoretical framework and the research methods descriptions that were used in each phase. All tasks and activities that encompassed the framework are described in details in sections 3.1.1 through 3.1.5.

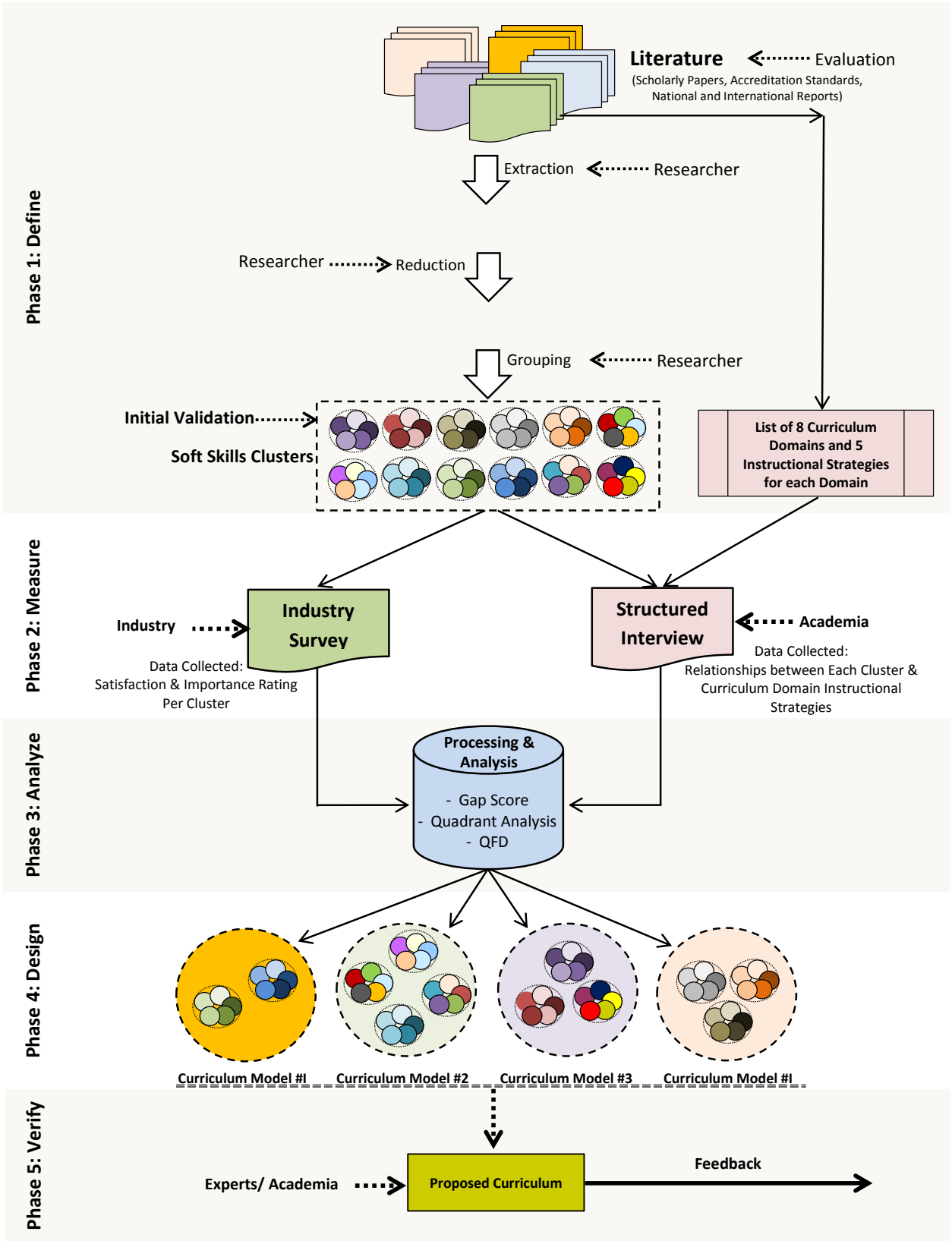



**Figure 3.1: The Theoretical Framework**

**Table 3.1: Summary for the Framework objectives, outputs, and outlines the main research Tools/Techniques**

| Phase | Objectives | Tasks | Research Methods |
|---|---|---|---|
| **1. DEFINE** | Define the construction-related soft skills | A soft skills taxonomy | ▪ Literature-base discovery<br>▪ Kj method<br>▪ Mind map<br>▪ Triangulation |
| | Define the best practices in teaching soft skills | A list of curriculum instructional strategies | ▪ Literature review |
| **2. MEASURE** | Benchmark the existing state of the soft skills taxonomy among construction graduates | Industry survey | ▪ Survey<br>▪ Pilot project<br>▪ Descriptive statistics |
| | Measure the relationship between the soft skills taxonomy and the list of existing instructional strategies | Structured interview | ▪ Structured interview<br>▪ Pilot project |
| **3. ANALYZE** | Calculate the soft skills clusters gap score | The gap score analysis | ▪ Services quality model |
| | Group the soft skills clusters into four sets and prioritize them | The quadrant analysis to achieve a2. | ▪ Quadrants analysis |
| | Calculate the relative weight for each curriculum instructional strategy | The quality function deployment (QFD) analysis | ▪ Quality function deployment (QFD) |
| **3. DESIGN** | Determine the effective strategies for each curriculum domain | Design four soft skills curriculum models | ▪ Normative judgment |
| | Present the researcher understanding to the results | Proposing a curriculum scenario | ▪ Reflection |
| **4. VERIFY** | Verify the quality of the proposed soft skills instructional curriculum results | Experts feedback | ▪ Interview |

**Table 3.2: Summary of the major research methods that will be used in the research**

| Phase | Research Method | Description |
|---|---|---|
| **1. Define** | Literature-based discovery | Literature-based discovery refers to the use of papers and other academic publications to find new relationships between existing knowledge (Chen et al. 2011). |
| | KJ Method | "Six Sigma" tool for organizing ideas into categories based on their underlying similarity (Shafer et al. 2005). |
| | Mind-Map Application: | The mind-map principle is based on associative logics and is used for defining the problem to Mind-mapping; can be performed individually or in a group session. |
| | Data Triangulation | A technique that facilitates validation of data through cross verification from two or more sources (Gonsier-Gerdin 1998). |
| **2. Measure** | The Industry Survey | An instrument that uses question-based surveys to collect information about how people think and act to assess their thoughts, opinions, and feelings using the internet (Fink 2003). This research constructs a survey instrument using concepts from the Service Quality model (Parasuraman et al. 1985). This model suggests that employers judge the Service Quality by comparing their opinion regarding the perceptions of the service that they did receive (actual service performance) with his opinion regarding the expectations of the service that they should have received. |
| | The Structured Interview | Fixed format interview in which all questions are prepared beforehand and are put in the same order to each interviewee. Although this style lacks the free flow of a friendly conversation (as in an unstructured Interview) it provides the precision and reliability required in certain situations (www.businessdictionary.com). |
| | Pilot project | In this phase, pilot project refers to the use of the data collection instruments as planned for the intended research on a smaller scale sample. The pilot project strategy was used in the research to reduce the likelihood of errors and test the feasibility of the instrument in reality. |
| | Descriptive statistics | Discipline of quantitatively describing the main features of a collection of information, or the quantitative description itself |
| **3. Analyze** | Gap Analysis | The comparison of actual performance with potential performance. Identifies gaps between the optimized allocation and integration of the inputs (resources), and the current allocation level. This reveals areas that can be improved. This research will use the SERVQUAL definition (Parasuraman et al. 1985) which defines the gap as the difference between the employer satisfaction about the quality of soft skills among construction graduates, and their ranking for the importance of that soft skills. |
| | Quadrant Analysis | It is a simple way to organize customer satisfaction importance data into four quadrants that will tell you how and where to improve your business operations (Gonzalez et al. 2008). |
| | Quality Function Deployment | A method to transform qualitative user demands into quantitative parameters, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process (Akao 1994). |
| **4. Design** | Normative Judgment | It is one that states some value or evaluative rule as a standard of other judgments, or applies such a value or rule to specific cases. It tells us how things ought to be, what kinds of actions we ought to do (Bell et al. 1988). |
| | Reflection | The researcher's thoughts that reflect his understanding of the research results and his vision for future work. |
| **5. Verify** | Interview | This is an interview with two to three learning experts to discuss and get feedback from experts about the research outputs. |

### 3.2.1. The Define Phase:

The Objectives of this phase are:

- Define the construction-related soft skills.
- Define the effective strategies in teaching soft skills.

To achieve these objectives, two tasks were conducted: develop a soft skills taxonomy, and develop a list of curriculum instructional strategies. The following is a detailed description of both tasks.

**Develop a soft skills taxonomy:**

Reviewing the literature revealed two common strategies that can be used to define construction-related soft skills. The first one is by asking the industry experts about the needed skills, then developing a list for these skills, e.g. (Gonzalez et al. 2008). The second strategy involves preparing a list of the expected industry needs by the researcher/ research team, e.g. (Ahn et al. 2012).

To address the research problem "*The existing content, definition, interpretations, and approaches for soft skills used among construction educators and employers are not clear*" (Mahasneh and Thabet 2015), the latter strategy was used by reorganizing the existing soft skills knowledge developed by other researchers where possible. It is expected that applying this strategy will offer a more accurate understanding of the exact industry needs and more likely include a vast number of skills (a holistic approach).

An iterative approach to identify the construction-related soft skills was developed by adopting the Literature-Based Discovery (LBD) method (Ganiz et al. 2005) and affinity diagrams method (KJ method) (Shimura 2005). The research used the convenient literature documents to extract the soft skills and plot them in a soft skills list. The list was further reduced and organized into a taxonomy of 12 clusters. The taxonomy was shared with experts from academia and industry and was further updated based on their feedback. This was accomplished in three steps as follows:

1. **Developing the soft skills inventory list:** The Literature-Based Discovery method was used to establish an inventory list of soft skills. Google Scholar was used to conduct a random search for the terminologies: "soft skills", "no-technical skills, "employability skills", "competences", "leadership", "emotional intelligence", and "construction related skills". A pool of documents was defined and reduced to 32 relevant literature documents after a

thorough review. The selected documents were derived from multiple sources of knowledge, including accreditation standards, governmental reports/standards frameworks, international reports/standards, construction literature, and other disciplines' literature.

The skills were extracted from the 32 literature documents based on the researcher's definition for the soft skills which is "*the needed ability and traits that are often used to describe the non-technical skills*" (Mahasneh and Thabet 2015). The extracted skills were coded and added together into a list. The list was reduced by removing repetition. The reduced list is referred to as the soft skills inventory.

2. **Grouping the Soft Skills into taxonomy of 12 Clusters:** The KJ method was used to group the soft skills inventory into 12 clusters. The use of KJ method makes the skills visually controlled and immediately accessible. The rationality of organizing the relevant soft skills into a cluster can remove some of the subjectivity surrounding a single skill.

   Each soft skill from the inventory list was written on a sticky note as seen in Figure 3.2. The notes were sorted by placing relevant soft skills into relevant groups as shown in Figure 3.3. The grouping decision was based on the existent knowledge and researcher's understanding gained from the 32 literature documents.

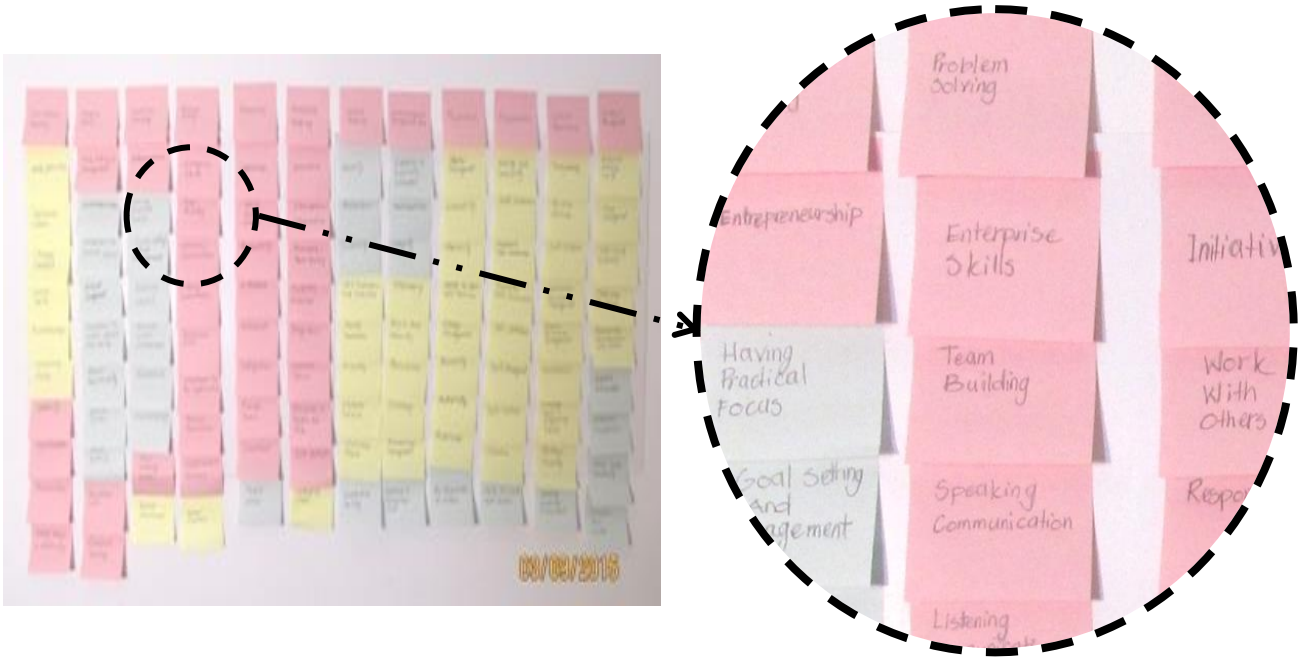



**Figure 3.2: Writing the skills in sticky notes**

For each group, a title was chosen that best describes all soft skills in that group.

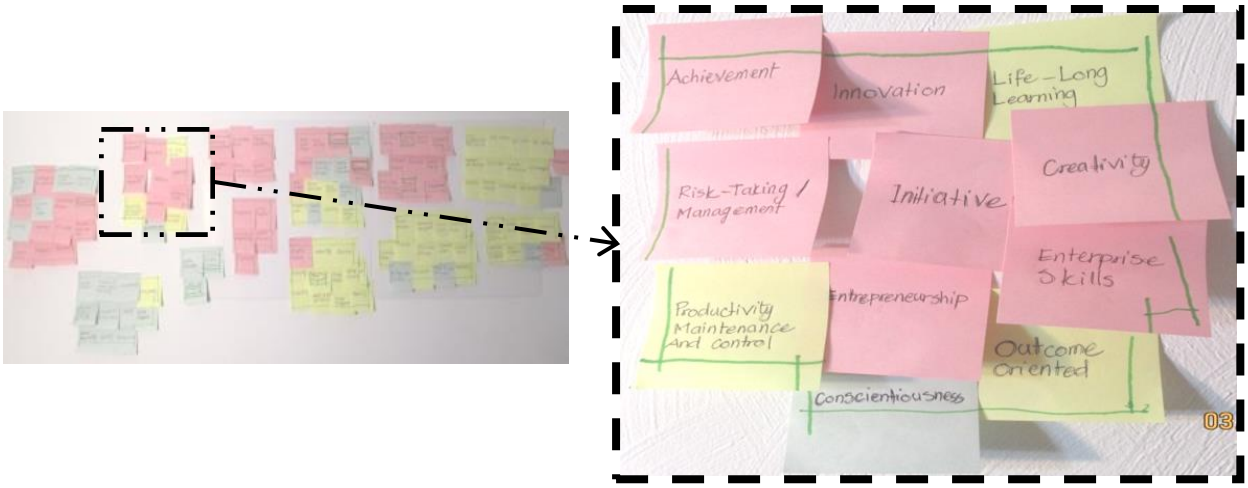



**Figure 3.3: The soft skills grouping**

3. **Mind Map Software**: The Mind Map software was used to repeat the grouping backward to check the work reliability as shown in Figure 3.4. In this case, the sorting started by plotting the 12 clusters' titles first, then adding the relevant skills into its relevant group. The grouping decision was based on the experience and knowledge of the researcher and his understanding gained from the 32 documents reviewed. The two results (i.e. the manual and electronic) were compared to check for similarities and differences. The final soft skills taxonomy was proposed.

4. **Verify the clusters**: The proposed taxonomy was shared with experts from the industry and academia. Based on their feedback, the taxonomy was updated.

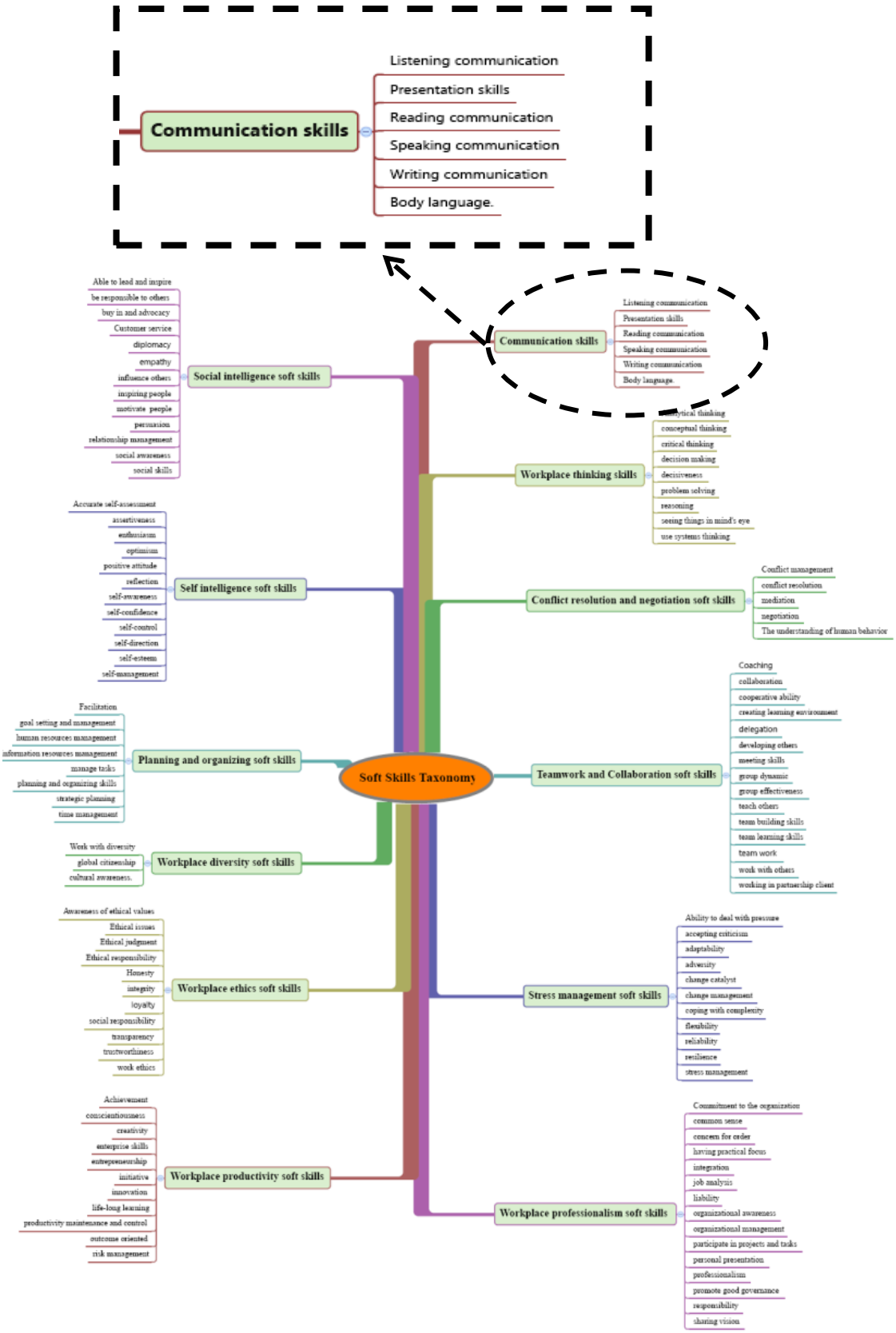



**Figure 3.4: The Soft Skills Taxonomy Using Mind Map**

**Developing a list of curriculum instructional strategies:**

The curriculum is a formal academic plan that guides the students' learning in pursuit of a college degree (DEZURE 2002). The literature contains a vast number of curriculum theories that govern and unify any curriculum research. This research was limited to be unified by the structural curriculum theory which defines the worthwhile subject matter selection method and justifies the process (Hameyer 1991). Also, it explains how to organize the meaningful knowledge within a curriculum so that it transforms that knowledge into rigorous and relevant quality learning activities and instructional standards that will help educators better prepare construction students for future industry career opportunities.

To address the research problem "*Current adopted solutions to bridge the soft skills gap are unstructured*" (Mahasneh and Thabet 2015), it has been determined to organize and define the effective strategies in teaching soft skills. This was done by developing a list of eight curriculum domains (i.e. a specified knowledge), and analyzing five instructional strategies for each domain in order to define the effective strategies. In this phase (Define), a list of existing strategies in teaching soft skills was developed, whereas determining the best strategies for each domain occurred in the following phases.

It is important to mention that the vast majority of curriculum scholars highlighted four curriculum domains as critical components of any good curriculum. These four domains are: method of course delivery, pedagogical approach, course assessment, and course feedback (Eash 1991). On the contrary, other instructional domains were less regarded or scarcely existed in curriculum research. However, few scholars argued that in addition to the previous four domains, another four domains should be considered for succeeding in the curriculum implementation. Those were the students' academic level, the learning resources, the class environment, and the educator's experience. The decision of limiting the number of instructional strategies in this research to five for each domain was decided due to resource limitations.

The list of effective strategies in teaching soft skills was developed using literature documents. They were extracted and categorized into eight domains. The list was organized as a spreadsheet format that contains the domains and instructional strategies. The following is a detailed description for this process.

**1. Evaluate and Define the Source Knowledge:**

The same pool of literature document that was used in defining a soft skills taxonomy was used to identify the list of instructional strategies. Literature that was highly focused on proposing method(s) or practice(s) to implement skills or competences in undergraduate education within or across disciplines was identified. The documents represented grassroots movements, innovations, reforms efforts, and individual initiatives in the field. They also identified patterns and themes across a wide range of skills through teaching and learning practices.

**2. Extracting the strategies from the literature documents:**

The instructional strategies were extracted from the literature documents. In most cases, the instructional strategy was clearly stated in the document; if not, the context of the document was used to support the rationality of picking a specific strategy.

3. **Categorizing the curriculum instructional components and its options:**

The extracted instructional strategies were categorized in the eight curriculum domains. The instructional strategies were limited to the most effective five strategies for each domain. This decision was based on the researcher's experience. Excess strategies were eliminated. Figure 3.5 demonstrates an example of the list spreadsheet.

| # | Curriculum Domain | Strategies |
|---|---|---|
| 1 | **Method of course delivery:** | Online class, Stand-Alone, integrated in curriculum, learning contract class and accelerated class. |
| 2 | **The Pedagogical Approach:** | |
| 3 | **Course Assessment:** | |
| 4 | **Course Feedback:** | |
| 5 | **Student academic level:** | |
| 6 | **Course Learning resources:** | |
| 7 | **Classroom size and layout:** | |
| 8 | **Instructor(s) background:** | |

**Figure 3.5: Example to demonstrate the format of the existing instructional strategies list (The detailed List will be presented in chapter 4)**

### 3.2.2. The Measure Phase:

The objectives of this phase are:

- Benchmark the current actual performance of the soft skills taxonomy among construction graduates.
- Measure the relationship between the soft skills taxonomy and the list of curriculum instructional strategies.

To achieve these objectives, two data collection methods were used: an industry survey, and a structured interview. The following is a detailed description of the two data collection methods.

**The Industry Survey:**

To address the research problem "*Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap*", and benchmark the current actual performance of the soft skills taxonomy among construction graduates, an industry survey instrument was used.

The industry survey aims to collect input from construction industry experts regarding the relative importance of the soft skills clusters to their work, and their satisfaction about the actual performance of soft skills among the construction graduate in an entry level position.

The survey acknowledged principles from Service Quality (SERVQUAL) Model or the gap performance model (Zeithaml et al. 1990). The SERVQUAL Model is a diagnostic tool that is used to measure the customer service by a comparison of expectations (E) with performance (P) (SERVQUAL = E-P) (Antony and Preece 2002; Parasuraman et al. 1985). The model has proven to be the best method to measure customer satisfaction. Some scholars proved that it offers consistence and reliable measures (Parasuraman et al. 1985). For the scope of this research, the gap performance model concept has been used to develop the industry survey combined with the following principles:

1. The assumption that higher education is a service industry (Antony and Preece 2002) in which different stakeholder groups considered customers to include existing and potential students, employees, faculty members, employers, government, families, and industry (Antony and Preece 2002).

2. The assumption that SERVQUAL can be measured using a survey and the customer feedback (The industry experts) can be transformed into measurable quantitative data (Zeithaml et al. 1990).
3. The assumption that the industry experts' perspective should be used in evaluating the construction graduate in entry-level positions. This decision has been taken based on Dr. Akao's Model (Akao et al. 1996), in which he strongly suggested that the best evaluator for the higher education graduates is the employers (The industry experts).

Building on the previous discussion, the survey instrument was developed using the "Qualtrics" online survey software (https://virginiatech.qualtrics.com). After the consent page, the survey instrument consisted of 21 questions as follows:

- The first 13 questions focused on requesting input on rating the level of the respondent's relative importance of each soft skills cluster (as expectation), and how satisfied they were with their entry-level construction graduates' ability to apply the skills within the cluster on the job (as Performance). The questions covered the 12 soft skills clusters in addition to a question that covered the overall soft skills.

  The overall question is a common question in SERVQUAL surveys and is used as an indicator to analyze the survey data statistical significance correlations. Also, the overall question is used to investigate the existence of a correlation between the overall soft skills and the 12 clusters.

  A directional statement preceded the 13 questions as shown in Figure 3.6. Its primary goal is to provide the respondents with focused directions to answer the questions.

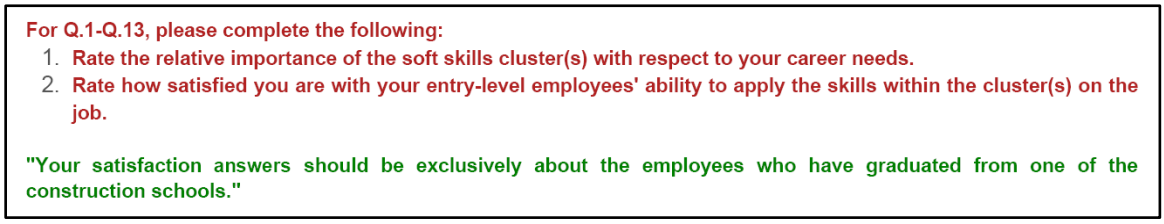



**Figure 3.6: The directional statement**

The 13 questions used the same structure and the same scale (i.e. Likert scale). Each question addressed a different cluster from the taxonomy in addition to the overall soft skills (i.e. question 13). Figure 3.7 demonstrates an example for the 13 questions' structure and scale.

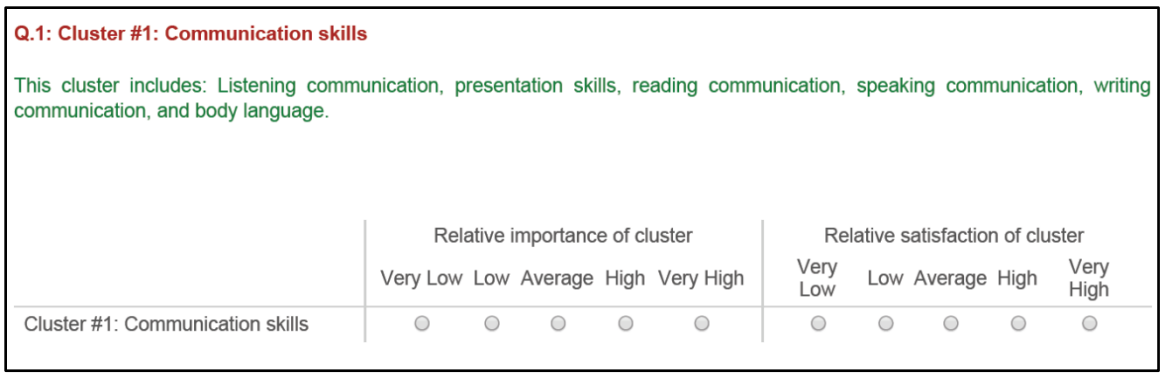



**Figure 3.7: Example that show the structure of the 13 Questions (All questions will be presented in chapter 5)**

- The 14th question is a Y/N question, and focuses on requesting the respondent's input on his agreement with the 12 clusters' definitions and categorization. If he answered "no", another sub question will request his input on adding/defining additional cluster(s), and on adding/defining what skills might be included in this new cluster(s).
- Finally, questions 15 through 21 focused on capturing demographic information from the respondents such as: gender, age, primary job function, experience, geographical distribution, type of organization, and the size of the organization.

The survey instrument was presented to experts in order to review the instrument's design, samples, procedure, and data analysis. The instrument was updated based on feedback given and was used in a pilot project.

The invited participants were all construction experts in a position to assess soft skills among construction graduates. The survey used a stratified random sampling method. The participants were identified using LinkedIn website (www.linkedin.com). After closing the survey, data was statistically analyzed to check the internal reliability and validity for the data.

**The Structured Interview:**

To address the research problem "*Current adopted solutions to bridge the soft skills gap are unstructured"*, it was determined to define the effective curriculum instructional strategies and organize them into a list. The list was developed in the previous phase (Define) as a first step. Measuring the relationship between the soft skills taxonomy and the list of curriculum instructional strategies would be the second step to address this problem. The effective strategies will be defined in the design phase.

The structured interview acknowledged the principles of the Quality Function Deployment (QFD) implementation. The QFD is used in the next phase (Analyze) to calculate qualitative weight for each curriculum instructional strategy. The use of QFD in education research is documented to the early 90s (Chen and Chen 2001); the researchers used it in curriculum design and review (Aytac and Deniz 2005). The QFD is used in construction research as well (Dikmen et al. 2005), (Gargione 1999); the researchers suggested using it as a strategic decision-making tool or in the design phase of a project. QFD is used in this research to create and maintain prioritized decisions aligned with industry requirements.

Keeping in mind the assumption that higher education is a service industry (Antony and Preece 2002), the use of QFD tool is to design effective curriculum. The use of QDF requires the following steps:

1. Define the WHATs; this has been done by defining the soft skills taxonomy.
2. Define the HOWs; this has been done by defining the curriculum instructional startegies.
3. Define interrelationship wieght between the WHATs and the HOWs; this has been done using structured interviw data.
4. Define the WHATs importance rating; this has been done using the survey data.
5. Calcualte the HOWs scoring; this has been done in the next phase (Analyize).

The structured interview aimed to capture input from experts in academia regarding the relationships between each soft skills cluster in the taxonomy and the curriculum instructional strategies. In relation to this research, the relationship means "*the effectiveness of using the instructional strategies to teach a specific soft skills cluster.*"

Building on the previous discussion, the structured interview instrument was developed as a spreadsheet as shown in Figure 3.8. The spreadsheet is comprised of 41 columns and 14 rows. The first column on the left represents the 12 soft skills clusters. The top row represents the curriculum domains, and the row below that represents the curriculum instructional strategies. The empty intersected squares are to be filled in by the interviewee. Each empty square represents the interrelationship between each cluster and each strategy. The interviewee should answer with: strong, medium, weak, or leave blank. An introduction was added to the header of the paper stating the goals of the tool and how to complete the spreadsheet.

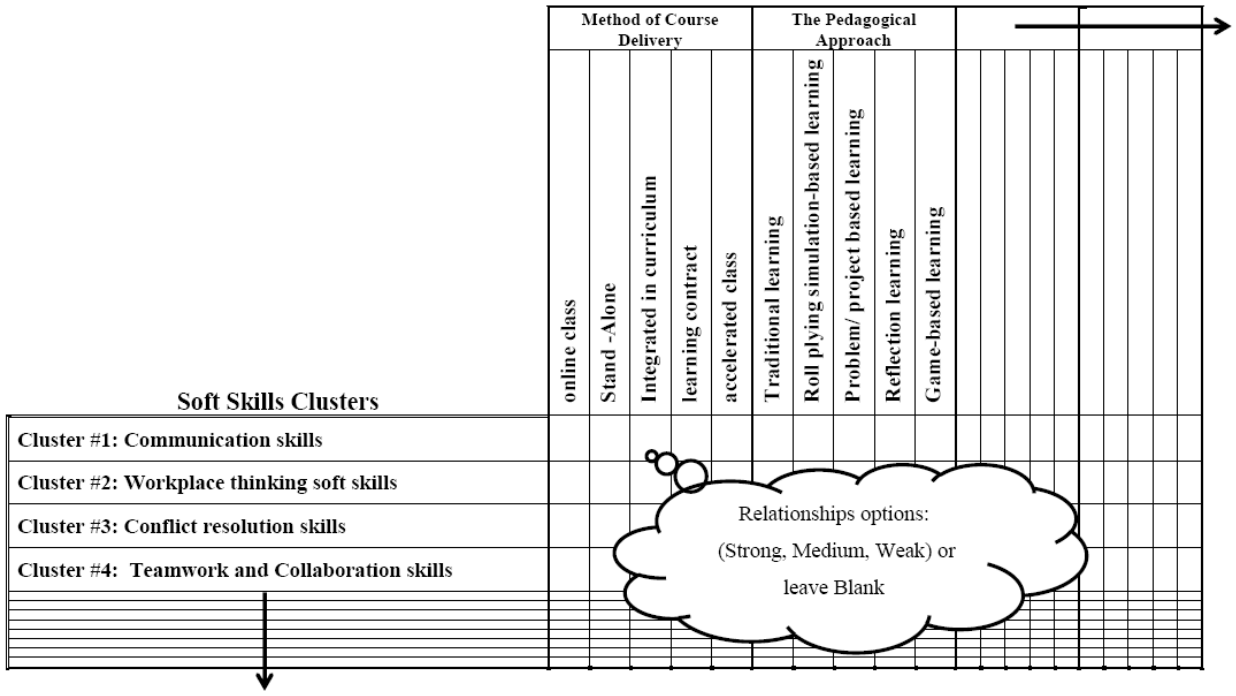



**Figure 3.8: The structured interview matrix**

The invited interviewees were academia experts in a position to define the relationships between the soft skills clusters and the curriculum instructional strategies. The research used non-probability convenient sample. Six experts on soft skills education were contacted based on their expertise and willingness to participate in the interview.

The interviewees were identified in two ways: some of them were the authors of a literature document that was used in this research; others were identified based on their contribution to the topic or related topic through presentations or scientific meetings. An online search was used to confirm their adequacy to this research and then contacted by email. Interviews were conducted face to face, and in some cases using video conference.

### 3.2.3. The Analyze Phase:

The objectives of this phase are:

- Calculate the soft skills clusters' gap score.
- Group the soft skills clusters into four sets and prioritize them.
- Calculate the relative weight for each curriculum instructional strategy.

To achieve these objectives, three sequential analysis methods were used as follows:

- Analysis #1: The Gap Score Analysis method.
- Analysis #2: The Quadrant Analysis method.

- Analysis #3: The Quality Function Deployment (QFD) Analysis method.

The following is a detailed description of the three analysis methods.

***Analysis #1: Gap Score Analysis***

The Gap Score Analysis method is used to calculate the soft skills gap score for each cluster (The actual performance for the soft skills among graduates. The gap score analysis method constructed from the Service Quality Model (Zeithaml et al. 1990). This analysis acknowledged the work of some scholars such as Gonzalez and Lim (Gonzalez et al. 2008; Gonzalez et al. 2011; Lim et al. 2013) who used a comparison of the importance (the expectation) and satisfaction (the performance) to measure the gap ( the service quality) as per the equation:

**Gap Score (G) = Importance Mean Score (I) - Satisfaction Mean Score (S)**

The results were interpreted as follows:

- A positive score indicated that the cluster was more important to the respondents than their level of satisfaction. Therefore, an action is required.
- A negative score indicated that the respondents were more satisfied with the cluster performance level among graduates than its importance level. Therefore, no action is required.

Data from the industry survey was used to calculate the value averages and determine the Importance Mean Score (I) and the Satisfaction Mean Score (S). The equation G = I - S was then used to calculate the Gap Score (G).

The results of this calculation indicated that performance of graduates across the 12 clusters was less than what was expected. This is consistent with the early inferences from the pilot survey which was conducted earlier. It was therefore determined to group and prioritize the 12 clusters into four sets, and further develop four curriculum models using four QFD matrixes. Grouping the clusters into four sets influenced the use of the Quadrant Analysis method and acknowledged the previous research in such cases such as Gonzalez et al. (2008), Kamvysi et al. (2014), and Antony and Preece (2002).

***Analysis #2: The Quadrant Analysis***

The Quadrant Analysis (Lim et al. 2013) or Customer Window Quadrant (Gonzalez et al. 2008) was used to group the 12 soft skills clusters further into four sets based on their priority for improvement. For each cluster, The Importance Mean Score, and the Satisfaction Mean Score

were plotted in a quadrant diagram as shown in Figure 3.9. The overall average Importance Mean Score and the overall average Satisfaction Mean Score were also plotted as a line.

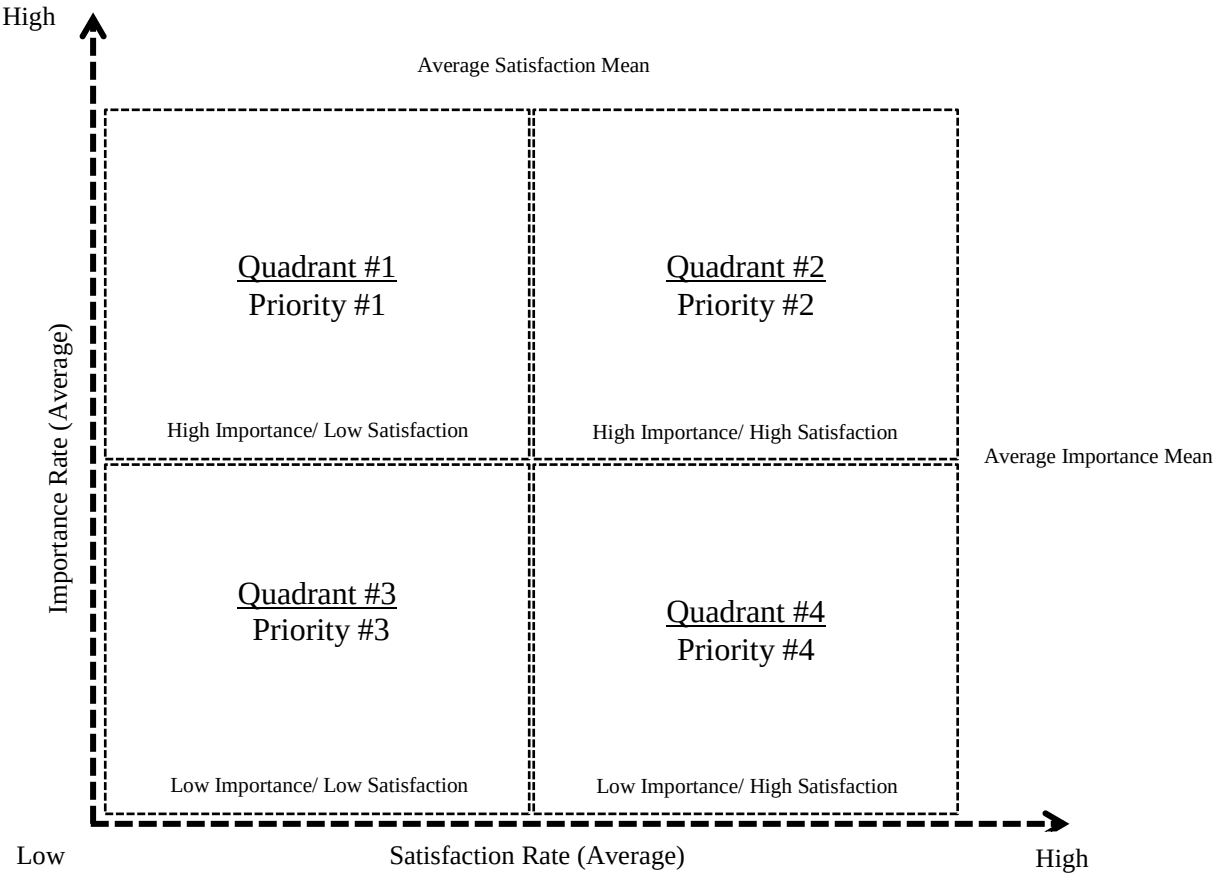



Figure 3.9: The Quadrants Analysis with Example of Clusters Plotting

The four quadrants are interpreted as follows:

- **Quadrant 1:** This is the critical quadrant. It contains all soft skills with High Importance/ Low Satisfaction. This is set #1 with priority #1.
- **Quadrant 2:** This is the Ideal quadrant. It contains all soft skills with High importance/ High Satisfaction. This is set #2 with priority #2.
- **Quadrant 3:** This is a lower priority quadrant. It contains all soft skills with Low importance/ Low Satisfaction. This is set #3 with priority #3.
- **Quadrant 4:** This is the least priority. It contains all soft skills with Low importance/ High Satisfaction. This is set #4 with priority #4.

The 4 sets are used to develop four curriculum models using four QFD matrixes. The knowledge content of each model and matrix was captured as follows:

- Model #1: QFD #1: All soft skills clusters in set #1.
- Model #2: QFD #2: All soft skills clusters in set #2.
- Model #3: QFD #3: All soft skills clusters in set #3.
- Model #4: QFD #4: All soft skills clusters in set #4.

***Analysis #3: The Quality Function Deployment (QFD) Analysis***

The QFD analysis aims to calculate a relative weight for each instructional strategy. QFD is a structured planning tool used to fulfill the customer expectations (Akao et al. 1996; Gonzalez et al. 2008; Xuemei and Shiju 2012). The QFD analysis was developed and applied to qaulity research by Japanese researchers by the early 70s (Chen and Chen 2001). They used it to identify and prioritize customer requirements and match these needs to corresponding products or service characteristics. Utilizing QFD usually appears in the form of "The House of Quality" (HOQ) (Chen and Chen 2001)**.**

The use of this method is based on data acquired from the soft skills taxonomy, the list of curriculum instructional strategies, the survey, the structured interview, and the quadrant analysis. The relative weights for all instructional strategies were used in determining the effective strategies for each curriculum domain in the Design Phase.

The QFD analysis aknowledge the perviously mentioned SERVQUAL principles, such as: defining the Higher Education as a service industry, defining the construction industry as customers, defining the graduate students as a product of higher education, and determining that the construction industry should evaluate the level of performance for soft skills acquired by construction graduates.

The QFD analysis was used to develop a QFD Matrix (i.e. house of quality) as shown in Figure 3.10. The QFD Matrix is comprimised of five rooms, which are:

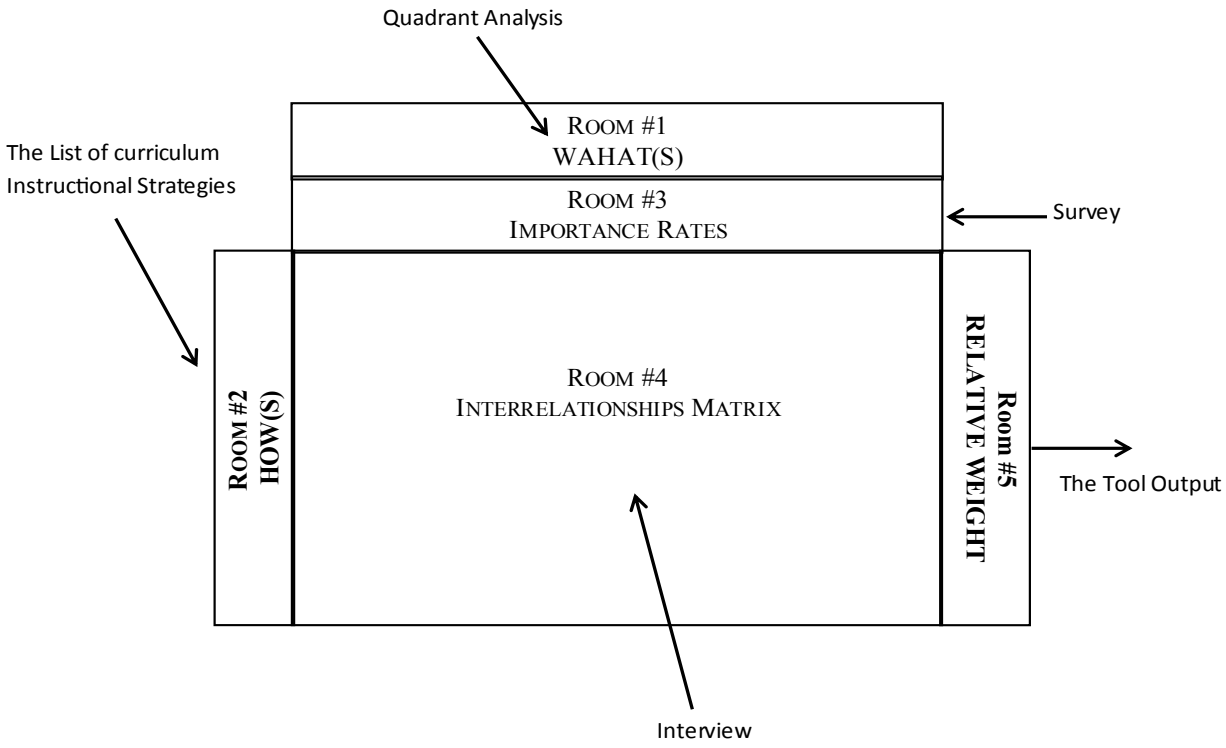



**Figure 3.10: The QFD Matrix**

**Room #1:** The industry requirment: This room represents one set of clusters which resulted from the quaderant analysis.

**Room #2:** The curriculum requirments: This room represents the eight curriculum domains and the five instructional strategies for each domain.

**Room #3:** The Importance rate value for the soft skills clusters within the cluster set: The importance rates are acquired from the industry survey.

**Room #4:** Interrelationship matrix: This room represents the relationships between each soft skills cluster and the curriculum instructional strategies. It acquiered data from the structured interview after replacing the words: (Strong, Medium and Weak); with numbers i.e (Strong = 7, Medium = 3, Weak = 1, and 0 for blank). The conflicts between the participants' opinions in the structured interviews were removed by using the average value for each respondent's opinion.

**Room #5:** Represents the curriculum instructional strategies scoring: It was calculated as follows: For each curriculum instructional strategy column, the score is the sum of the importance rates for each soft skills cluster multiplied by the value of the relationship.

Based on the quadrant analysis, four matrixes were uses as shown in figure 3.11, following the quadrant analysis.

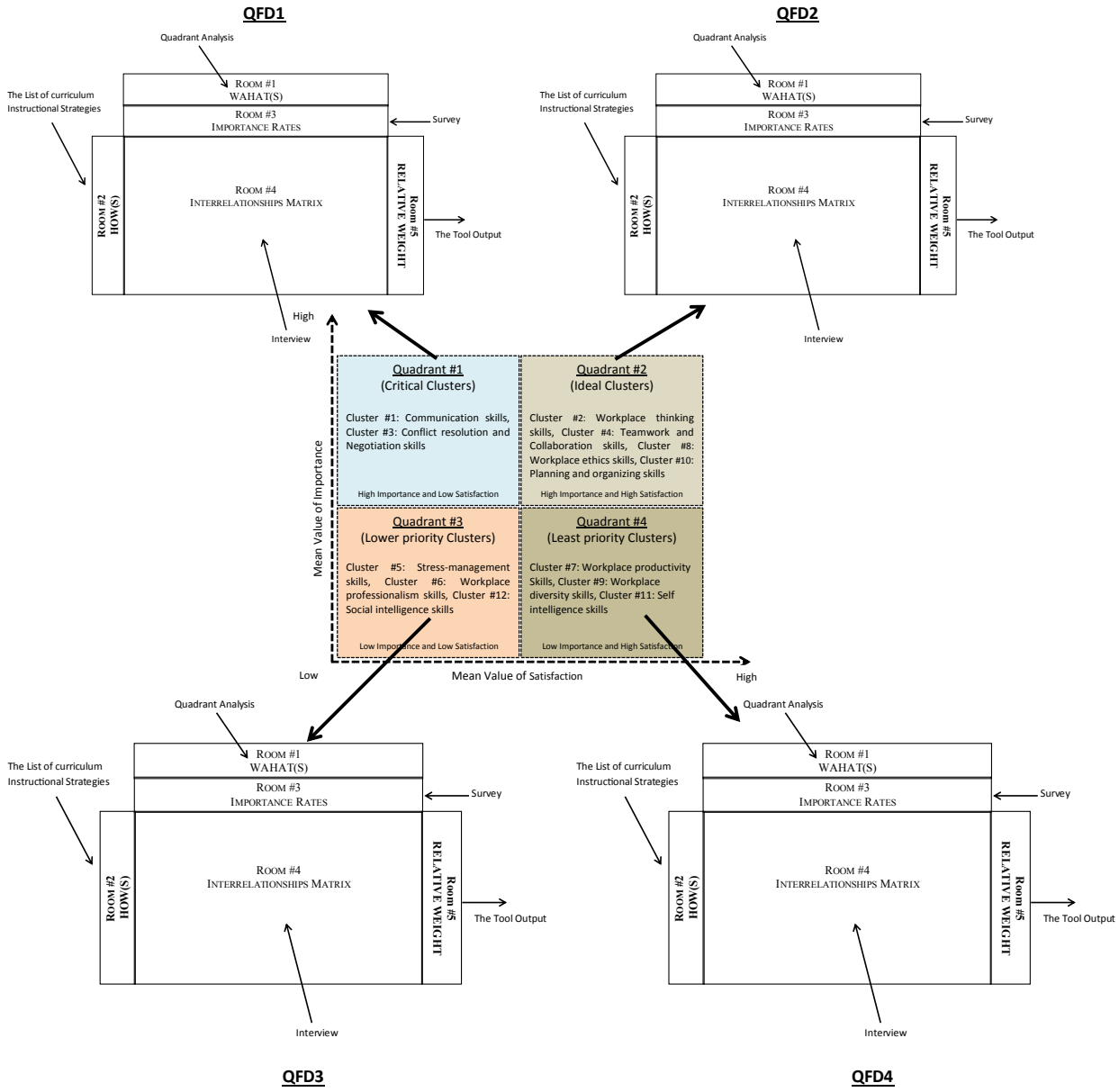



**Figure 3.11: The relationship between the four QFD matrixes and the quadrant analysis.**

### 3.2.4. The Design Phase:

The Objectives of this phase are:

- Determine the effective strategies for each curriculum domain.
- Present the researcher's understanding of the results.

To achieve these objectives, two tasks were conducted: design four soft skills curriculum models, and interpret the Design Phase results. The following is a detailed description for the taxonomy and the list.

***Curriculum Models:***

Using the data captured from the four QFD matrixes, four Curriculum models were proposed. The four models were determined based on the following:

- Model #1: Used decisions based on QFD #1, and set #1
- Model #2: Used decisions based on QFD #2, and set #2
- Model #3: Used decisions based on QFD #3, and set #3
- Model #4: Used decisions based on QFD #4, and set #4

As shown in 3.12, each model is comprised of:

1. The knowledge Content which is acquired from the quadrant analysis. The knowledge Content of each model is the soft clusters that were previously used in the model QFD matrix.
2. The model priority which is acquired from the quadrant analysis.
3. The model curriculum domains which are acquired from list of domains (Developed in Define phase). All models have the same eight domains.
4. The effective instructional strategies decisions which are acquired from the QFD analysis. Each domain had one or two effective strategies. They are the strategies with the higher relative weight in each domain.

***Interpreting the Design Phase Results:***

The proposed four models are a form of skeleton instructional strategies. Understanding those strategies rely on the experiential knowledge of the educators. Interpreting the Design Phase Results presents the researcher's personal thoughts on how to implement these strategies in class.

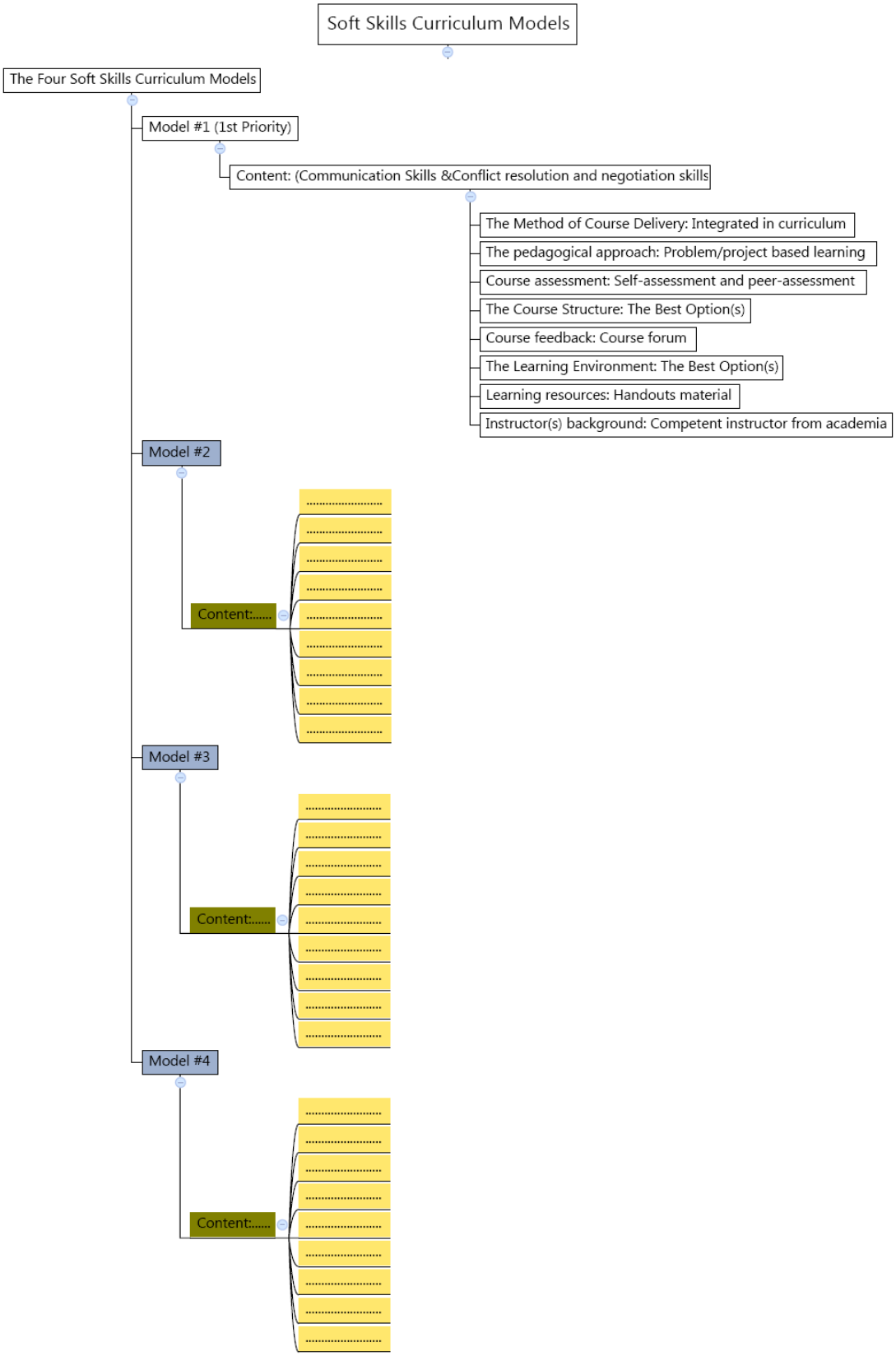



**Figure 3.12: The Proposed Four Models**

### 3.2.5. The Verify Phase:

The objective of this phase is to verify the visibility and the quality of the proposed soft skills instructional curriculum.

To achieve these objectives the research results were shared with four experts in soft skills education. The feedback aimed to share the research results with the experts to verify the curriculum models and to get their feedback on the quality of the result. A list of questions was prepared and sent to the experts via email along with a research summary document. The experts' feedback was documented as Appendix F and was summarized in Chapter 8.

### 3.3 The Research Design Strategy:

The research used the "**Research and Development**" type of research as a research design strategy. This strategy is widely used in educational studies, and differs from other types in that "*it focuses on the interaction between research and the production and evaluation of a new product*" (Postlethwaite 2005). The research collected and evaluated information about the research product (i.e. the major two outcomes from the research were the soft skills taxonomy and the soft skills curriculum models) during the development of the theoretical framework to modify and improve the products.

While the research type is Research and Development, the research typology was **Embedded Mixed-Method Research** based on Creswell's classification for educational research (Creswell and Plano Clark 2007), where the research collects and analyzes both quantitative and qualitative data within a traditional qualitative design.

The prior analysis for the research problem and sub-problems indicates that there is very little literature in the area of soft skills curriculum in general and particularly in construction research. Therefore, the research is exploratory research as well, so that it is **Exploratory Embedded Mixed-Method Research.**

Johnson et al. (2007) define the mixed-methods research as "*the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative approaches* (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding and corroboration." The research used the grounded theory approach in parallel with predefined existing model.

The research referred to the **Triangulation**, **Development** and **Initiation** reasoning using Greene's reasoning Model (Greene et al. 1989) to justify the use of the mixed-method. The research seeks to triangulate the results from the two methods to strengthen the final product (the soft skills curriculum framework), and to increase its validity by capitalizing on an inherent normative framework, whilst the initiation in this study was sought in the discovery of a new perspective of the soft skills curriculum framework design, that helps in implementing soft skills in construction education.

As a result, the research is considered as "**Fixed Mixed-Method design"**, where "*the use of quantitative and qualitative methods is predetermined and planned at the start of the research*

*process, and the procedures are implemented as planned*" (Clark and Creswell 2011). A direct interactive level happened between the two methods. They were mixed before the final interpretation. The mixing occurred at the "Define Phase."

The research utilized an **equal priority**. Also, it conducted **concurrent timing**: it implemented both the quantitative and qualitative strands during a single research study. However, it used a Montage strategy so that the research method's forefront focus will be shifted between qualitative and qualitative research concepts. Denzin and Lincoln (2000) discussed the montage concept as: "*In montage, several different images are juxtaposed to or superimposed on one another to create a picture. In a sense, montage is like pentimento, in which something was painted out of a picture (an image the painter "repented" or denied), becomes visible again, resulting in creating something new. What is new is what had been obscured by a previous image*."

### 3.4 Research Philosophical Assumptions:

Two research philosophy approaches were used in this research: The normative Approach and the Pragmatist Approach. The following is a detailed description on how they influenced the research.

**Normative Approach**: The research used normative concepts, components, theories, methods, tools, and techniques to increase the trustworthiness and credibility of the research decisions. However, when combining them together into one whole framework, it resulted in a theoretical framework that represented the design process for the targeted soft skills curriculum framework.

**Pragmatist Approach**: The research was influenced by the Pragmatism philosophical school. Pragmatism is an American philosophical movement concerned with knowledge that solves practical problems. Gilman (1989) defines pragmatism as *"dealing with the problems that exist in a specific situation in a reasonable and logical way instead of depending on ideas and theories.*" In a pragmatic research, the knowledge claims actions, the problem is the most important, and the researcher will use all approaches to understand the problems that "*best meet their needs, purposes and best address their research questions*" (Creswell 2013). Also, "*truth and value can only be determined by practical application and consequences*" (O'Leary 2007).

### 3.5 Developing the Theoretical Framework:

This research was started with defining the soft skills gap among construction graduates as a research problem. The major sub-problems that contribute to the existence of this gap were defined using the literature-based discovery, and criteria that would define the needed solution. After that, the researcher defined three case studies; each one of them represents a different research strategy to solve the soft skills gap among graduates in general. Using a normative analysis, based on the pre-developed criteria (chapter 2), a research framework was defined based on the three case studies. Then, that pre-existing framework was adopted and formulated under a grounded theory method umbrella to suit the research goals and objectives as a theoretical framework for the research.

While it is not easy to use an existing theoretical framework within the methodological guidelines of a grounded theory, many researchers started advocating the transformation of grounded theory as an approach that can be used with a pre-existing theoretical framework (Seaman 2008). Charmaz (2006) confirms that we "*can use basic grounded theory guidelines with twenty-first century methodological assumptions and approaches.*" Therefore, the research refers to the rationality of the previous argument in order to shift the methodological assumption of the grounded theory and to help the researcher "*develop explanatory theory concerning common social life patterns*" (Annells 1996).

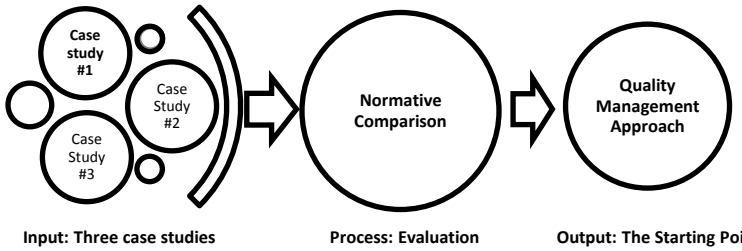
Grounded theory is an inductive research methodology that has been long used in educational research. According to (Glaser and Strauss 2009), grounded theory is "the discovery of theory from data." Strauss and Corbin (1990) provide a more detailed definition; they state: "*A grounded theory is one that is inductively derived from the study of the phenomenon it represents. That is, it is discovered, developed and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon*. *Therefore, data collection, analysis and theory stand in reciprocal relationship to one another*."

**Normative Case Study Analysis:**

There is a scarcity of a conceptual or theoretical framework to implement soft skills in higher-education curricula, whereas a well-known framework is totally absent in construction education. The research defined three case studies (scholarly examples) that present three different methodologies to deal with problems similar to this research problem.

In the SAGE handbook of qualitative research, Denzin and Lincoln (2011) propose two types of case study selections: the random selection and information-oriented selection. Under the information-oriented one, they list four sub-types: extreme/deviant cases, maximum variation cases, critical cases, and paradigmatic cases. The latter one, which they suggest using "*to develop a metaphor or establish a school for the domain which the case concerns,*" was chosen for this research. This is because it is appropriate as a research starting point and will function as the focus for the research knowledge base.

A normative analysis for the three case studies leads to refine, evolve, propose, and initiate the research theoretical framework. The third case study, which used the Total Quality Management (TQM) approach as a theoretical framework, was selected as the best research approach. Figure 3.13 conceptualizes this process.




**Case study #1:** Delphi Method: From paper entitled "Understanding the most critical skills for managing IT projects: A Delphi study of IT project managers" by Keil et al. (2013).
**Case study #2:** Statistical Based Approach: From paper entitled "Key Competencies for U.S. Construction Graduates: Industry Perspective) by Ahn et al. (2012).
**Case study #3:** Quality Management System: From paper entitled "Designing a supply chain management academic curriculum using QFD and benchmarking" by (Gonzalez et al. 2008).

**Figure 3.13: Using three case studies to define the theoretical framework**

While the three case studies are capable of producing the intended results, the normative selection strategy defined case study #3 as the best one amongst them based on pre-defined criteria. Table 2 summarizes the evaluation criteria.

**Table 3.2: The Case studies Evaluation Criteria**

| **The Predefined Criteria:** | Case Study | | |
|---|---|---|---|
| | **#1** | **#2** | **#3** |
| Standardizing the soft skills and using them all to design the solution. | √ | √ | √ |
| Clearly organizing the industry and academia input in developing the remedies. | X | X | √ |
| Prioritizing the soft skills based on the construction industry's needs. | √ | √ | √ |
| Benchmarking the existing state of soft skills among construction graduates. | X | X | √ |
| Setting future development goals. | X | X | X |
| Propose continuous development method. | X | X | √ |
| **Decision:** Case Study #3 is the best methodology that can match the majority of pre-defined features | | | |

The case study #3 was developed and implemented two decades ago. Recent quality publication indicates a shift in the interest of using TQM as a quality management system to using Six Sigma even with the large number of success stories (Yang 2012). This is due to the disciplined quality that Six Sigma system could offer and a similar TQM quality results. Also, a notable number of TQM projects had failed or had negative results' impact (Yang 2012).

Thus, to enrich the value of the selection finding and to offer a stronger decision, it was determined to follow the new strand in research and use Six Sigma as a conceptual framework: it was found that Six Sigma will add the missing feature (Setting future development goals) to the research framework.

Six Sigma is a well-known methodology that was originally designed to reduce defects in manufacturing processes (Evans and Lindsay 2014). The six sigma concepts are viewed as a systematic, scientific, statistical, and smarter approach to improve the quality and management innovation in education (Paramasivam and Muthusamy 2012). Using Six Sigma framework required existing quality data. Since this is an exploratory research and there is no existing quality data about the existence of soft skills in construction industry or education, the research will use **Design for Six Sigma** (DFSS) framework as a preliminary theoretical framework. The DFSS proposes five sequential concepts for design (Figure 3.14), which are: Define, Measure, Analyze, Design, Verify (**DMADV**). Also, it is important to mention that QFD is an essential research tool in any Six Sigma Framework and usually implemented in the Analyze phase.

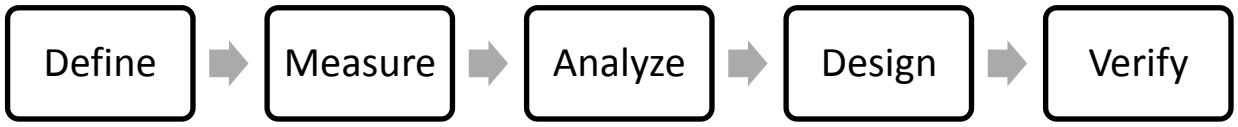



**Figure 3.14: The Preliminary Framework**

**Is Design for Six Sigma methodology appropriate for use in this study?**

While it is not empirically proven that Six Sigma and QFD can improve the quality of higher education since they are fresh quality strategies in higher education, there are an increasing number of researchers who propose using the Six Sigma Methodology as an effective tool in design curriculum in higher-education.

Reviewing the higher-education literature reveals more examples of using the DFSS and QFD in curriculum design to satisfy the industry's need and/or to increase the quality of learning outcomes. Examples of that literature are:

- Examples of using six sigma concepts Higher-education research: (Yu and Ueng 2012), (Sharma et al. 2013), (Douglas et al. 2013), (Svensson et al. 2013), (Paramasivam and Muthusamy 2012), (Al-Thani et al. 2014), (Antony 2014).
- Examples of using DFSS concepts in Higher-education research: (Namasivayam et al. 2013), (Paramasivam and Muthusamy 2012), (Goh and Lam 2010), (Cudney and Kanigolla 2014), (Campatelli et al. 2011).
- Examples of using QFD concepts in Higher-education research: (Gonzalez et al. 2011), (Yeung 2010), (Xuemei and Shiju 2012), (Kamvysi et al. 2014), (von Konsky et al. 2014), (Simatupang and Togar 2011), (Liu et al. 2013).

The use of Six Sigma, Design for Six sigma and QFD concepts and frameworks exists in construction research. The following are examples that support this argument:

- Examples of using six sigma concepts in construction research: (Banawi and Bilec 2014), (van den Bos et al. 2014), (Wang et al. 2014), (Lee and Su 2012), (Shan and Li 2013), (Al-Aomar 2012), (Büyüközkan and Öztürkcan 2010).
- Examples of using DFFS methodology in construction research: (Koziołek and Derlukiewicz 2012), (Lee and Su 2012), (Abdelhamid 2003), (Ferng and Price 2005), (Vilasini et al. 2014), (Paslawski 2013).

Clearly, using Six Sigma, DFSS, and QFD concepts exist in the higher-education research agenda across all disciplines, as well as in the construction research agenda. Thus, it is acceptable to use the same concepts in construction education research, and consequently, in this study.

### 3.6 The Data Collection Quality Plan:

The validity, reliability, and bias are the major quality assessment tools for any study. While reliability is necessary, it is not sufficient alone. This research is committed to a high quality of reliability and internal validity with minimum bias.

The research used two types of analysis for the theoretical framework, the Logical Congruence and the framework visibility. During the preparation of the research plan, the research used the relational planning technique "**Logical Congruence**" to logically reason the research design process. The Critical reasoning analysis compares judgments with the world's views and the framework knowledge by highlighting the strengths of the framework and examining inherent problems. To insure the framework visibility, the research applied **"a pilot project"** strategy to test the theoretical framework visibility ahead.

Also the research referred to the "**methodological triangulation**" to enhance the confidence in the research findings. Originally, the triangulation metaphor is a navigation and military strategy that uses multiple reference points to locate the object's exact position (Jick 1979). Denzin (1970) defines triangulation in research as "the *combination of methodologies in the study of the same phenomenon.*" He proposed four types of triangulation: data triangulation, investigator triangulation, theoretical triangulation, and methodological triangulation. The research used them all.

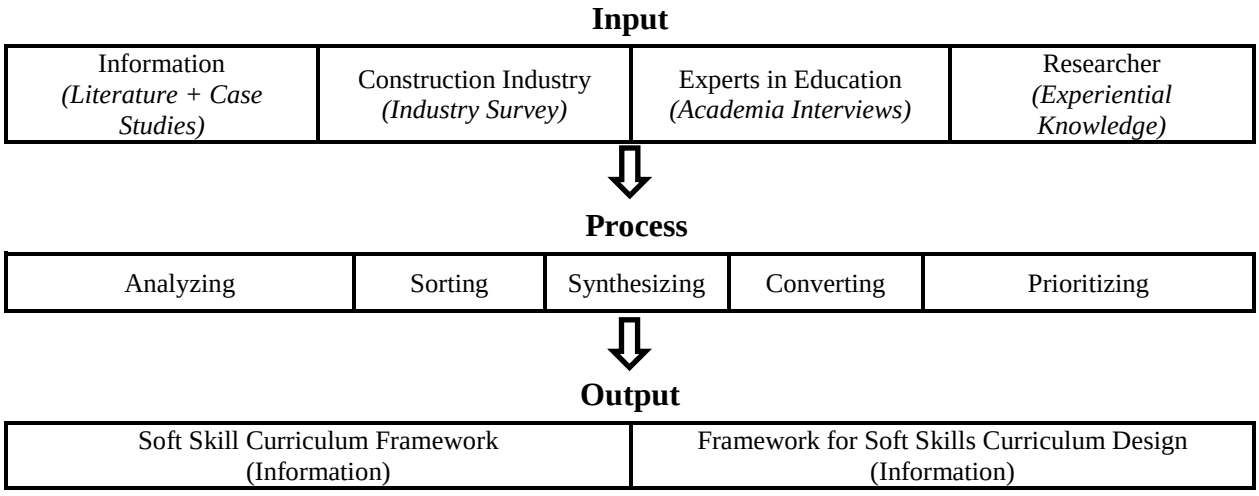



**Figure 3.15: The Research Information System**

Figure 3.15 conceptualizes the research information system framework. The framework shows that the research used four main data collection methods: literature based information including

the use for case studies, employer satisfaction/importance survey, structured interview with experts in education, and the experiential knowledge of the researcher.

**Research Validation Scheme:**

Recent publications in mixed methods research validation focuses on assessing the validity for the overall research rather than assessing its components both quantitative and qualitative. Several publications have now been written discussing this argument (Onwuegbuzie and Johnson 2006, Tashakkori and Teddlie 2008, Clark and Creswell 2011). The research will follow this argument so that the main validation assessment will be in the last phase (Verify Phase). The research will accomplish that using the inference quality concept suggested by (Tashakkori and Teddlie 2008). The research seeks for judgments about the ‘‘Overall Research Validity”.

According to Tashakkori and Teddlie, inference quality is a combination of design quality and interpretive rigor of the research. The good design quality refers to whether or not the theoretical framework adheres to bests practice. The good interpretive rigor refers to the level of research trustworthiness. For them it is the umbrella that connotes the process of interpreting the findings, as well as, the outcomes of interpretation, and the ability to provide answers to the research questions. The research used inference quality by one or more experts in curriculum design during the implementation of the “verify phase” of the framework.

The research used Evidence of validity (such as face, construct, predictive, concurrent, consequential and content) prior to the validity phase to support and establish the research credibility, transferability, dependability, and conformability. Credibility and dependability will be established by using the triangulation technique. The transferability will be established by providing sufficient detail and/or richness while describing the research process, data collection, analysis, and all research decisions so that the reader can interpret and make since of the work (thick description). Finally, the conformability will be accomplished by using the normative analysis to justify the major decisions during the research, and by providing a solid logical transfer between the research steps and phases. The researcher believes that this validation scheme will increase the research trustworthiness and ultimately the research validity.

**Validity Evidences during Implementation:**

Table 3.3 summarizes the validation techniques that were used during the framework implementation:

Table 3.3: The research Validation techniques

| PHASE | METHOD OF VALIDITY |
|---|---|
| **DEFINE** | The research used Data Triangulation technique (Lipshitz and Cohen 2005) to increase the soft skills clusters' credibility. Multiple sources of information/ data to support the development of soft skills taxonomy were used. The source of information/ data are:<br>▪ The trusted literature publications (scholarly papers, standards and reports). The holistic approach to collect all possible soft skills from literature will be used. This is to ensure that soft skills (as the main focus to be covered in the research) is fairly representative and addressed in depth and breadth (Holism validation (Lipshitz and Cohen 2005).<br>▪ The researcher is a key research instrument in this phase supported by his experiential knowledge. The clustering decisions will be supported by the same decisions in literature.<br>▪ The industry survey will have a validation question regarding soft skills clusters definition. The survey instrument will be tested in a pilot survey (*Please refer to Appendix 1: The Industry Survey*).<br>▪ Sharing the clusters with peer colleagues in construction academia in the form of poster and paper(s) to get their feedback (construct validity). |
| **MEASURE** | **Validation of the two instruments:** The industry survey instrument and the structured interview matrix instrument were presented to experts and were tested in a pilot data collection prior to the implementation (Content Validity (Lipshitz and Cohen 2005)).<br>**Validation of survey data:** The relationship between satisfaction and importance for each question was checked using Pearson correlation coefficient or eta coefficient. |
| **ANALYZE** | N/A |
| **DESIGN** | N/A |
| **VERIFY** | The research findings were shared with four experts in soft skills education from academia. The sharing aims to assess the level of confidence in the research results, and its compatibility with the research goal and objectives. Also, to check if the research processes were adherents to the best practices, whether all research questions were answered, whether there were gaps in the framework, and to get the respondents feedback and comments on the ability of implementing the curriculum in education and how to strengthen the framework for future studies (Inference Quality (Tashakkori and Teddlie 2008)). |

**Ethical Considerations**: All information collected and received from the respondents was treated with confidentiality without disclosure of the respondents' identity. Information was presented as collected and all literature collected for the purposes of this research were acknowledged in the references section.

# CHAPTER 4: THE DEFINE PHASE

## 4.1 Introduction:

This chapter discusses in detail the first phase of the proposed theoretical framework: The Define Phase. It has two main objectives:

- Define the construction-related soft skills.
- Define the effective strategies in teaching soft skills.

To achieve these objectives, two tasks were conducted: developing a soft skills taxonomy to achieve D1, and developing a list of curriculum instructional strategies to achieve D2.

This chapter introduced a new technique to define a novel soft skills taxonomy based on the discovered knowledge that existed in the 32 literature documents, supported by the researcher's expertise. An iterative approach was used by adapting the Literature-Based Discovery method and the KJ Method. Using a Literature-Based Discovery method, the researcher is identified and analyzed a set of 32 literature documents, which addressed the soft skills classification/frameworks across a variety of disciplines. The soft skills were extracted individually and coded into an inventory list. The inventory list was reduced to a shorter list of 120 skills, and then the skills were classified/ grouped in 12 clusters using Affinity Diagrams Technique. The process of classification and clustering of the skills was repeated two times to increase the classification reliability. The resulting novel soft skills taxonomy was validated and shared with experts from industry and academia to establish a higher level of validity.

Subsequently, the same pool of literature documents that was used in defining the soft skills taxonomy was used to define the effective strategies in teaching soft skills. The convenient literature documents were identified, and the effective instructional strategies were documented and sorted into eight curriculum domains. For each domain, the list was limited to five strategies. The following is a detailed description for the soft skills taxonomy and the curriculum instructional strategies list.

The highlighted area in Figure 4.1 illustrates the scope of this chapter within the proposed theoretical framework.

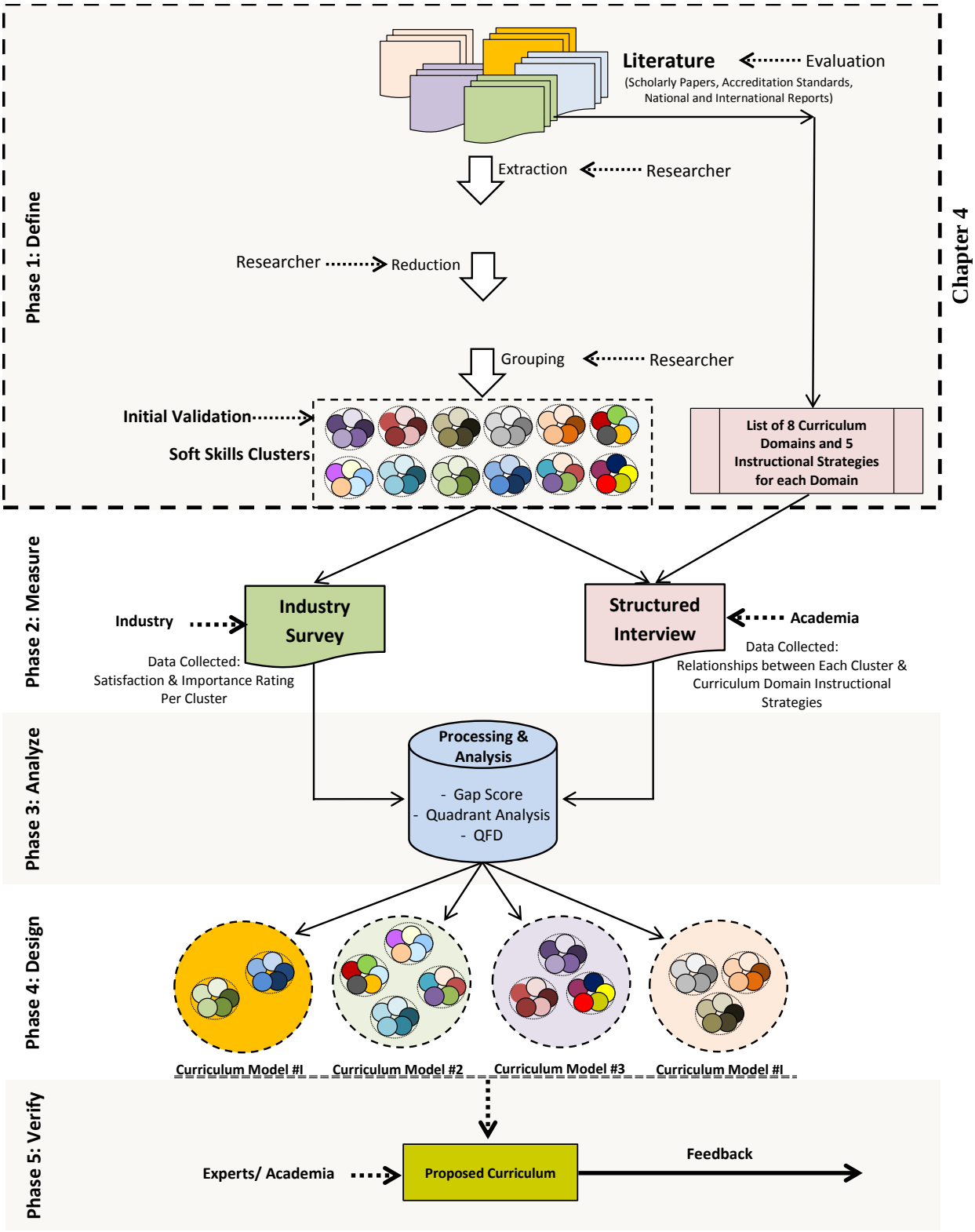



**Figure 4.1: The scope of chapter 4 within the proposed theoretical framework**

### 4.2. Developing the Soft Skills Taxonomy:

To develop a soft skills taxonomy, an iterative approach was used by adapting the LBD method and the KJ Method (sometimes referred to as affinity diagrams). The LBD method is a method that uses scholarly documents in order to define new relationships between existing knowledge, and produce trustworthy results (Ganiz et al. 2005; Mahasneh and Thabet 2015). It was used as a methodology umbrella that connected all steps, starting with defining the published scholarly literature (Existing Knowledge) as input data, which is a major character in the LBD method (Ganiz et al. 2005). Using scholarly publications offered a stronger trustworthy input for the research and better inclusion for different viewpoints.

The KJ method is a decision-making and problem solving Japanese tool, used to organize a large number of ideas/themes into a relationship skeleton using cards/sticky notes (Shimura 2005). The KJ method was adapted to be used as a tool under the LDB method.

The soft skills were extracted from the identified literature, listed in a table, normalized by removing the redundancy and/or repetition among them. The KJ method was used to organize the list into a new hierarchical taxonomy. Striving to find the hidden discovery is a major character in LBD method, the discovered connections and relationships among different arguments supported by the researchers experience influenced the KJ method decisions.

Figure 4.2 conceptualizes the process for developing the soft skills taxonomy. This was achieved in seven steps:

Step 1: Evaluate and define the existing knowledge.

Step 2: Extract the soft skills from the literature documents.

Step 3: Soft skills reduction.

Step 4: Soft skills grouping.

Step 5: Share and update the soft skills taxonomy.

Step 6: The proposed normative soft skills taxonomy.

Step 7: The proposed soft skills taxonomy to be used:

The following sections describe the 7steps in more detail.

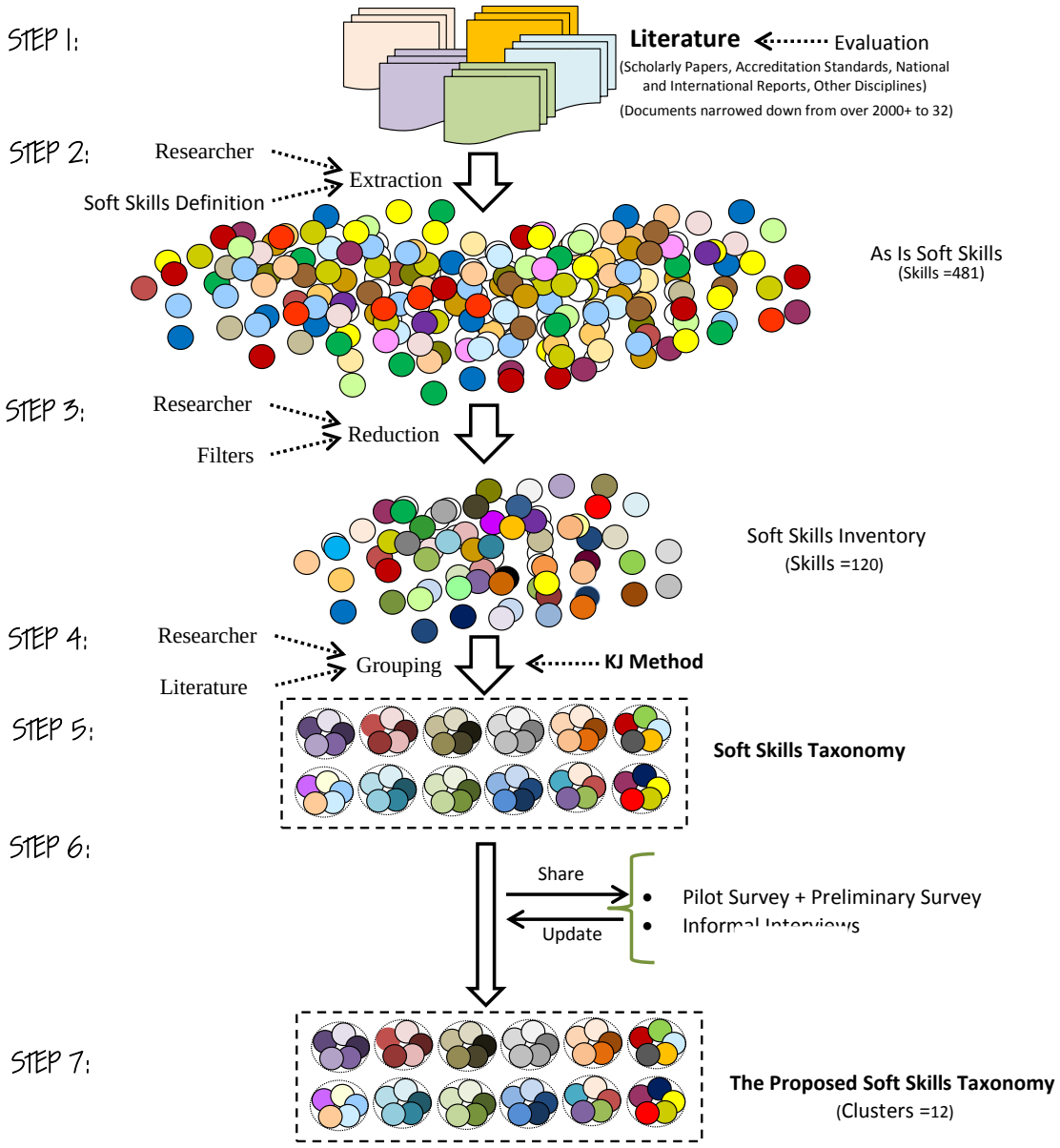



**Figure 4.2: The criteria for defining soft skills clusters under LBD**

### STEP 1: Evaluate and Define the Existing Knowledge:

Google Scholar was used to conduct a random search for the terminologies: "soft skills", "no-technical skills, "employability skills", "competences", "leadership", "emotional intelligence", and "construction related skills". (2000+) of scholarly publication documents were collected and downloaded. The abstract for each document was read and the documents were classified based on their relevancy to the research. Mahasneh and Thabet (2015) define soft as "*the needed ability and traits that are often used to describe the non-technical skills."* This definition was used to

limit the number of literature documents that can effectively serve the research to (100+) documents.

A more focused evaluation was conducted on the (100+) documents. The topics relevancy, the data quality, the document methodology, the document references, the reputation of the author and his institute, the document publisher's reputation, and in some cases the number of citations for that document were assessed. This process identified 32 literature documents that had a high relevancy to the soft skills domain. Across these documents, soft skills were defined under different classifications, such as: competencies, employability, leadership, emotional intelligence, etc. Also, it addressed multidimensional perspective examples that counts as good practices in the domain. Figure 4.3 summaries the different levels of effort in identifying the 32 literature documents.

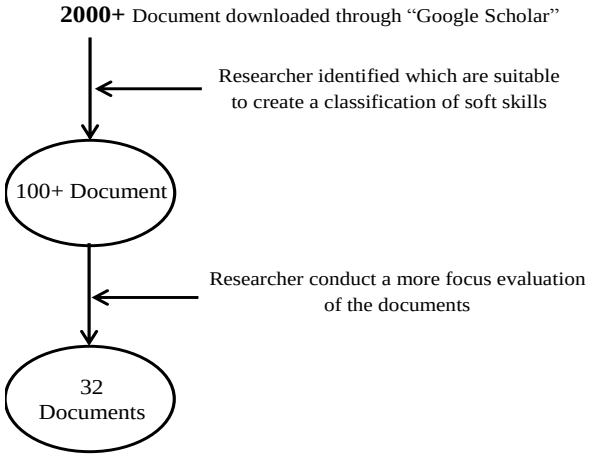



**Figure 4.3: Different levels of effort in identifying the 32 documents**

The 32 literature documents were classified, coded, and listed as shown in Table 4.1. The source of the literature documents included:

- The bachelor degree accreditation standards of the American Council for Construction Education (ACCE), and Accreditation Board for Engineering and Technology (ABET).
- The United States governmental standards/ reports documents.
- The international standards/ reports documents: Cases from European Union, Australia and Canada.
- The construction related scholarly publication documents.
- Scholarly Papers Related to soft skills: Cases from other disciplines (Dental Education, Business Administration Education, Total Quality Management Information Technology), Employers in general (Service firms, trade firms, production firms), Office Technology Education and civil engineering.

**Table 4.1: Best Practice documents that were used in defining soft skills**

| # | Document |
|---|---|
| 1. | Standards And Criteria For Accreditation Of Postsecondary Construction Education Degree Programs (ACCE 2014). |
| 2. | Criteria For Accrediting Engineering Technology Programs, 2014-2015 (ABET October 26, 2013). |
| 3. | The report of the secretary's commission on achieving necessary skills (SCANS) (Kane et al. 1990). |
| 4. | Lifelong soft skills framework: creating a workforce that works (Governments 2012). |
| 5. | Workplace Basics: The Skills Employers Want (Carnevale 1988). |
| 6. | Framework for 21st century learning (Skills 2011). |
| 7. | Key Competences For Lifelong Learning: European Reference Framework (Figel 2007). |
| 8. | Graduate Employability Skills Prepared for the Business, Industry, and Higher Education Collaboration Council (Cleary et al. 2007). |
| 9. | Employability Skills 2000+ (Canada 1992). |
| 10. | Defining generic skills at a glance (Authority 2003). |
| 11. | Report on Skills Gaps (Aring 2012). |
| 12. | The Hard Truth about Graduate Employability and Soft Skills (Malhi 2009). |
| 13. | Ranking of key competencies needed to be an effective project manager in the U.S. commercial construction industry (Cline and Robson 2013). |
| 14. | Key Competencies For U.S. Construction Graduates: Industry Perspective (Ahn, Annie, & Kwon, 2012). |
| 15. | Soft Skills Implementation in Construction Management Program: A survey of Malaysian Public Universities (Affandi et al. 2012). |
| 16. | Skills, knowledge, and competencies for managing construction refurbishment works (Egbu 1999). |
| 17. | Soft skills implementation in construction Management program: a comparative study of Lecturers and students' perspective (Affandi et al. 2012). |
| 18. | Studies on Key Skills for Jobs that On-Site Professionals from Construction Industry Demand (Hwang et al. 2014). |
| 19. | Developing project management competency: perspectives from the construction industry (Edum-Fotwe and McCaffer 2000). |
| 20. | Projects and personalities: A framework for individualizing project management career development in the construction industry (Madter et al. 2012). |
| 21. | Evaluation Of Graduate Learning Outcomes Using Constructive Alignment in Australia (Mills and McLaughlin). |
| 22. | Primal Leadership: Learning to Lead with Emotional Intelligence (Golemon et al. 2004). |
| 23. | Leadership Education and Training "Leadership Skills Truly Make a Difference" (Badger et al. 2007). |
| 24. | Embedding Leadership Development in Construction Engineering and Management Education (Riley et al. 2008). |
| 25. | Learning the soft skills of leadership (Crosbie 2005). |
| 26. | Soft skills and dental education (Gonzalez et al. 2013). |
| 27. | Concrete Steps for Assessing the "Soft Skills" in an MBA Program (Ingols and Shapiro 2014). |
| 28. | Soft Skills for TQM in Higher Education Standards (van Kemenade 2012). |
| 29. | Accommodating Soft Skills in Software Project Management (Sukhoo et al. 2005). |
| 30. | Soft And Hard Skills Development: A Current Situation In Serbian Companies (Babić and Slavković 2011). |
| 31. | Teaching Soft Skills Employers Need (Ellis et al. 2014). |
| 32. | Civil engineering body of knowledge for the 21st century: Preparing the civil engineer for the future (Committee 2004). |

***STEP 2: Extract Soft Skills from the Literature Documents:***

The definition of soft skills "*the needed ability and traits that are often used to describe the non-technical skills*" is used as the base to extract all soft skills from the 32 literature documents. After a thorough and iterative review of the documents, 497 skills were extracted and documented in a list as shown in appendix 1. They represent each word, a group of words, a sentence, or group of sentences "the context" that corresponds to that prior definition.

All extracted skills were considered equally important. Many of the soft skills overlapped and interlocked. This means that some aspects in one soft skill are essential for and/or support another soft skill. However, the research documented the skills as they were found in the documents.

The existing classification for the skills in the 32 literature documents started from the topmost level of classification hierarchy and merged to a single term / terminology. Terminologies such as: basic skills, interpersonal skills, personal qualities, group effectiveness, learning and innovation skills, life and career skills, fundamental skills, personal, cognitive skills, and interpersonal interactive skills are considered a topmost hierarchy level of classification. They were excluded during the recording process. Given that, yielding the topmost level of abstraction was less informative for the clustering. Also, the yielding may produce biased and conflicted results.

***STEP 3: Soft Skills Reduction:***

This step refers to the process of focusing, simplifying, abstracting, and transforming the soft skills extracted in Step 2. It ensures that there is no redundancy or repetition among the skills. Transactional reduction approach was used and it encompasses two filters. Those filters were:

- Filter #1: Remove repetition for the soft skills repeated more than once:
  **For example:** The skill adaptability was repeated eight times.
- Filter #2: Normalize terminologies that have the same meaning: This is done by removing the skills that have the same meaning. In eight cases a new terminology was used to represent them.
  **For example:** The skill adaptability was found in different terminologies like adapt to change, be adaptable, being adaptable to change at work.
  **Another example:** Writing communication was used to represent: Writing, writing skills, being able to spell and write well, general and business correspondence, report writing, the ability to communicate in writing

Appendix 2 summarizes the process of applying the two filters. The first filter reduced the number of skills from 497 to 353 skills. The second filter reduced the list further to 120 skills. Table 4.2 presents the resultant 120 soft skills list.

**Table 4.2 : Soft Skill Inventory List**

| Skills Titles (Total = 120 skill) | | |
|---|---|---|
| Ability to deal with pressure | Enthusiasm | Productivity maintenance and control |
| Able to lead and inspire | Entrepreneurship | Professionalism |
| Able to manage tasks | Ethical issues | Promote good governance |
| Accepting criticism | Ethical judgment | Reading communication |
| Accurate self-assessment | Ethical responsibility | Reasoning |
| Achievement | Facilitation | Reflection |
| Adaptability | Flexibility | Relationship management |
| Adversity | Globalization | Reliability |
| Allocate resources | Goal setting and management | Resilience |
| Analytical thinking | Group dynamic | Responsibility |
| Assertiveness | Group effectiveness | Risk-management |
| Awareness of ethical values | Having practical focus | Seeing things in mind's eye |
| Be responsible to others | Honesty | Self-awareness |
| Buy in and advocacy | Influence others | Self-confidence |
| Change catalyst | Information resources management | Self-control |
| Change management | Initiative | Self-direction |
| Coaching | Innovation | Self-esteem |
| Collaboration | Inspiring people | Self-management |
| Commitment to the organization | Integration | Sharing visions |
| Common sense | Integrity | Social awareness |
| Communication skills | Job analysis | Social responsibility |
| Conceptual thinking | Liability | Social skills |
| Concern for order | Life-long learning | Speaking communication |
| Conflict management | Listening communication | Strategic planning |
| Conflict resolution | Loyalty | Stress management |
| Conscientiousness | Mediation | Teach others |
| Cooperative ability | Meetings skills | Team building skills |
| Coping with complexity | Motivate people | Team learning skills |
| Creating learning environment | Negotiation | Teamwork |
| Creativity | Optimism | The understanding of human behavior |
| Critical thinking | Organizational awareness | Thinking skills |
| Cultural awareness | Organizational management | Time management |
| Customer service | Outcome oriented | Transparency |
| Decision making | Participate in projects and tasks | Trustworthiness |
| Decisiveness | Personal presentation | Use systems thinking |
| Delegation | Persuasion | Work ethics |
| Developing others | Planning and organizing skills | Work with diversity |
| Diplomacy | Positive attitude | Work with others |
| Empathy | Presentation skills | Working in partnership client |
| Enterprise skills | Problem solving | Writing communication |

***STEP 4: Soft Skills Grouping:***

The KJ method was used to administer the classification and organization of the skills into clusters. While there is a huge interlocking among the skills, the literature documents' evaluation and exploration justify sorting the skills as highlighted in Appendix 3. In a few cases, the researcher's experience and understanding of the 32 documents influenced the decision. The following is the grouping process summary:

1. Prior to starting the clustering, the literature documents were reviewed multiple times. This provided a deep understanding of the content.
2. The 120 soft skills were written on colored post-it sticky notes. They were posted all together on a white wall (As shown in Figure 4.3).


**Figure 4.4: Soft skills inventory written on post- it sticky notes**

3. As a starting point, it was determined to group the skills that are related to communication in one cluster. A simple definition was developed by the researcher as guidance. All sticky note cards that fit under that definition were sorted and mounted together on nearby space.
4. The same process was followed to establish and sort the next nine clusters. Each cluster-related sticky-note was sorted and mounted together on a different space on the wall.
5. The skills that didn't fit into any of the 10 categories were lifted out and not forced into any cluster.

6. To accommodate the remaining skills that didn't fit into the first 10 clusters, two more clusters were added. One for the skills that address self-skills, and the other cluster for the social-skills. The sorting was influenced by the literature document #22. Figure 4.5 presents the skills after organizing them into 12 clusters.

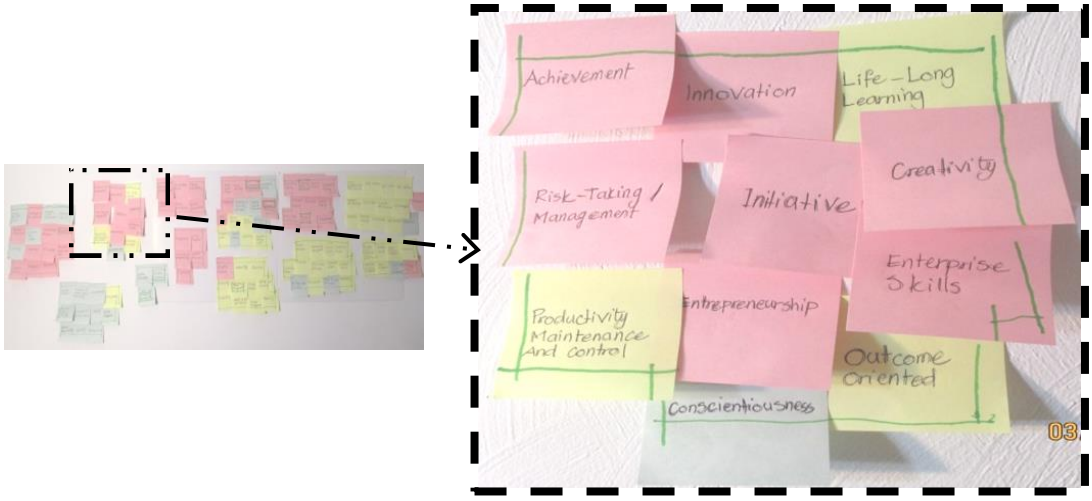


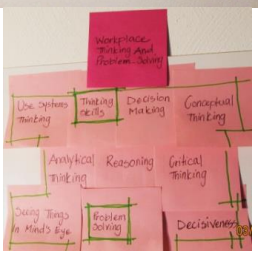

**Figure 4.5: The soft skills grouping**

7. Needless to say that the KJ method limits the number of categories/clusters derived to 10. However, based on the discovery, it was determined that 12 clusters will produce more accurate results in this study.
8. The need to add a new cluster was tested. It was obvious that there was no need to add more clusters beyond the twelve clusters.

   Finally, as shown in Figure 4.6, the twelve clusters were coded. For each cluster, the best title that represented all skills in that cluster was chosen for a title. In most cases that title was one of the skills in that cluster. However, some clusters got a new title. In the KJ method, this final step of giving a title, called HYOSATSU (Shimura 2005), is a Japanese term that can be defined as a "nameplate to be written down on the post-it sticky note and placed on the top of each cluster.

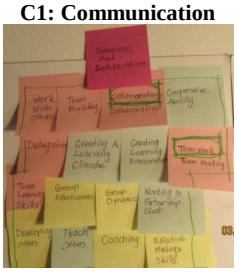


C1: Communication



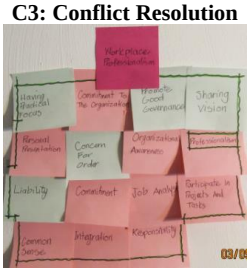

C2: Workplace Thinking


C3: Conflict Resolution



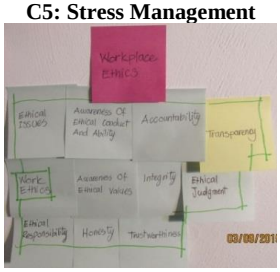

C4: Teamwork and Collaboration


C5: Stress Management




C6: Workplace Professionalism


C7: Workplace Productivity




C8: Workplace Ethics


C9: Workplace Diversity


C10: Planning and Organizing


C11: Self-Intelligence


C12: Social-Intelligence

**Figure 4.6: The clusters coding and titling**

The following are the Soft Skills Grouping Evaluation and Exploration:

**Cluster #1:**

The skills that refer to "the person's ability to understand and transfer information effectively through: thoughts, verbal and written words, as well as non-verbal signals" were clustered together. This decision was supported by the following discovery:

- Twenty-nine documents (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 28, 29, 30, 32) were found to include the aspect of this cluster in a unique category of their definition and/ or framework. Three documents (3, 7, 21) grouped reading, listening, speaking and writing skills together in one category.
- Ten documents (1, 2, 3, 5, 7, 11, 14, 16, 21, 24) were used as evidence to classify speaking in this cluster.
- Nine documents (1, 2, 3, 7, 11, 14, 16, 21, 24) were used as evidence to classify writing in this cluster.
- Four documents (3, 5, 7, 21) were used as evidence to classify listening in this cluster.
- Three documents (3, 7, 21) were used as evidence to classify reading in this cluster.
- One document (19) was used as evidence to classify presentation skills in this cluster.
- The document (13) highlights public speaking. This skill was counted as a speaking skill.

**Cluster Content:** Listening communication, presentation skills, reading communication, speaking communication, writing communication

**Cluster Title:** "Communication soft skills" was chosen to be the cluster title.

**Cluster #2:**

The skills that refer to "*the mental processes that the person applies when he seeks to make sense of experiences, finding solutions and/ or making solutions to complex issues*" were clustered together. This decision was supported by the following discovery:

- Twenty-seven documents (1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 20, 21, 23, 24, 26, 27, 28, 29, 30, 31, 32) were found to include the aspect of this cluster in a one unique category of their definition and/ or framework.
- The terminologies that are related to thinking were found in the documents (3, 5, 6, 9, 11, 12, 13, 20, 21, 26, 28, 29, 30, 32).
- The terminologies that are related to problem solving were found in the documents (1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 21, 23, 24, 27, 31).
- The documents (3, 6, 12) have evidence to categorize: problem solving, decision-making, critical thinking, reasoning, seeing things in mind's eye, and "use systems thinking" in one cluster.
- The rest of the skills were added to the cluster logically by the researcher.

**Cluster Content:** Analytical thinking, conceptual thinking, critical thinking, decision making, decisiveness, problem solving, reasoning, seeing things in mind's eye, and "use systems thinking"

**Cluster Title:** "Workplace thinking soft skills" was chosen to be the cluster title based on the categorizing of the documents (3, 6, 12).

**Cluster #3:**

The skills that refer to "the ability of the person to find a win/win solution to a personal, financial, political, or emotional disagreement with another party" were clustered together. This decision was supported by the following discovery:

- Nineteen documents (4, 5, 7, 11, 13, 14, 16, 17, 18, 19, 20, 22, 24, 27, 28, 29, 30, 32) were found to include the aspects of this cluster in one unique category of their definition and/ or framework.
- The terminology conflict management was found in the documents (4, 16, 18, 20, 22, 29, 32).
- The terminology conflict resolution was found in the documents (7, 14, 17).
- The terminology negotiation was found in the documents (5, 11, 13, 18, 19, 20, 24, 27, 28, 30, 31).
- The conflict management/ resolution and the negotiation were combined in one cluster based on the researcher's viewpoint.
- It was determined that using conflict resolution and negotiation soft skills would cover the mediation.

**Cluster Content:** Conflict management, conflict resolution, mediation, and negotiation

**Cluster Title:** "Conflict resolution and negotiation soft skills" was chosen to be the cluster title. The huge overlapping and interlocking between conflict management and conflict resolution made it hard to determine which terminology was stronger to use as a cluster title. Thus, the researcher searched them in Google scholar; the search using the exact phrase "Conflict resolution" revealed 1,130,000 results, and the search using the exact phrase "Conflict management" revealed 281,000 results (the percent is 4:1).

**Cluster #4:**

The skills that refer to "the ability to contribute to the group productive working and learning relationships and outcomes" were clustered together. This decision was supported by the following discovery:

- All documents were found to include the aspects of this cluster in a unique category of their definition and/ or framework.
- The terminology "teamwork" was found in one unique category in the content of the documents (1, 2, 4, 8, 9, 10, 12, 17, 19, 20, 21, 23, 26, 27, 28, 30, 32).
- The terminology "collaboration" was found in one unique category item in the content of the documents (6, 14, 11, 22, 25).
- Evidence that suggest combining "teamwork" skills and "collaboration" skills under one category were found in the documents (14, 22, 25).
- The documents; (9, 10, 17, 21, 23, 28) contained more evidence that support adding the rest of the skills to this cluster.
- The rest of the skills were added to the cluster logically by the researcher.

**Cluster Content:** Coaching, collaboration/collaborative, cooperative ability, creating learning environment, delegation, developing others, effective meeting skills, group dynamic, group effectiveness, teach others, team building skills, team learning skills, team work/team working, work with others, and working in partnership client

**Cluster Title:** "Teamwork and Collaboration soft skills" were chosen to be the cluster title. Both terminologies have the same meaning, yet in collaboration the team members are working jointly and making decisions together, rather than separately, completing their tasks.

**Cluster #5:**

The skills that refer to "*a wide spectrum of techniques that are aimed at controlling a person's levels of stress*" were clustered together. This decision was supported by the following discovery:

- Eighteen documents (4, 5, 6, 10, 12, 14, 15, 16, 20, 21, 22, 23, 24, 27, 28, 29, 30, 32) were found to include the aspect of this cluster in one unique or more categories of their definition and/ or framework.
- The document (10) has evidence to categorize Reliability, Ability to deal with pressure, and Adaptability together in one cluster. Evidence existed in the documents (4) and (6) to support adding flexibility.
- There is a huge overlapping and interlocking between all skills in this cluster and stress management. Thus, stress management was added to this cluster. The terminology stress management was found to be included as a unique category in the documents (16, 24, 27, 29, 32).
- The rest of the skills were added to the cluster logically by the researcher.

**Cluster Content:** Ability to deal with pressure, accepting criticism, adaptability, adversity, change catalyst, change management, coping with complexity, flexibility, reliability, resilience, and stress management

**Cluster Title:** "Stress management soft skills" was chosen to be the cluster title.

**Cluster #6:**

The skills that refer to "*the group of skills that indicates that the person genuinely performs his/her tasks in the organization, and maintains professional etiquette in the workplace*" were clustered together. This decision was supported by the following discovery:

- There is no strong evidence that supports the relationship between the skills in this cluster. However, evidence that influence establishing a cluster for the skills that are strongly related to the organization and professionalism was found in the documents (13, 14, 18, 20, 26, 29).
- All skills that weren't classified under any other clusters and shared the above definition aspect were added to this cluster**.**

**Cluster Content:** Commitment to the organization, common sense, concern for order, having practical focus, integration, job analysis, liability, organizational awareness, participate in projects and tasks, personal presentation, professionalism, promote good governance, responsibility, and sharing vision

**Cluster Title:** "Workplace professionalism soft skills" was chosen to be the cluster title. The researcher is convinced that this title can represent all skills in this cluster.

**Cluster #7:**

The skills that refer to "*the willingness at all levels to keep learning, improving and investing in skills while achieving the efficient and effective workplace inputs and outputs*" were clustered together. This decision was supported by the following discovery:

- Evidence influence establishing a unique cluster for the learning skills was found in the documents (1, 3, 5, 6, 7, 9, 10, 11, 12, 14, 26, 27, 28, 31).
- The documents (6, 7, 8, 10, 11) grouped Creativity, Innovation with creativity, and long-life learning in one category.
- The document (7) grouped initiative, entrepreneurship, creativity, innovation, and risk-taking soft skills together.
- The document (10) grouped initiative and enterprise skills together and defined them as the skills that contribute to innovative outcomes.

**Cluster Content:** Achievement, conscientiousness, creativity, enterprise skills, entrepreneurship, initiative, innovation, life-long learning, outcome oriented, productivity maintenance and control, and risk taking/management

**Cluster Title:** While the skills existed as unique categories in many documents, the skills definitions shared workplace productivity aspects. Thus, "workplace productivity soft skills**"** was chosen to be the cluster title.

**Cluster #8:**

The skills that refer to "the ability to defend and recommend concepts of right and wrong conducted in the workplace" were clustered together. This decision was supported by the following discovery:

- Twelve documents (1, 2, 4, 11, 12, 12, 14, 18, 21, 24, 27, 28) were found to include the aspect of workplace ethics in a unique category of their definition and/ or framework.
- The document (14) was used as evidence to categorize ethical responsibility, awareness of ethical conduct, and ability in this cluster.
- The document (28) was used as evidence to categorize ethical responsibility and trustworthiness in this cluster.
- The documents (3, 10, 12, 23, 30) were used as evidence to categorize honesty, integrity in this cluster.

**Cluster Content:** Awareness of ethical conduct and ability, awareness of ethical values, ethical issues, ethical judgment, ethical responsibility, honesty, integrity, transparency, trustworthiness, and work ethics

**Cluster Title:** "Workplace ethics soft skills" was chosen to be the cluster title.

**Cluster #9:**

The skills that refer to *"the ability to understand the variety of differences between people in an organization"* were clustered together. This decision was supported by the following discovery:

- The terminology diversity was found to be included in a unique category in the content of the documents (2, 3, 4, 11, 30). The terminology cultural awareness was found to be included as a unique skill in the content of the documents (6, 7, 16, 21).
- Evidence of the relationship between work with diversity, global citizenship, and cultural awareness skills was found in the documents (6, 11).

**Cluster Content:** Work with diversity, global citizenship, and cultural awareness

**Cluster Title:** "Workplace diversity soft skills" was chosen to be the cluster title. Diversity includes the other two skills in this cluster and it is widely used in literature. For example: Searching the World Wide Web using the exact phrase "Diversity" revealed 2,730,000 in Google Scholar search engine, compared with 30,200 results for "global citizenship" and 86,000 results for "cultural awareness."

**Cluster #10:**

The skills that refer to "*the long-term and short-term strategic planning*" were clustered together. This decision was supported by the following discovery:

- The aspects of this cluster were found to be included as a unique category in the documents (1, 3, 4, 6, 7, 8, 10, 12, 14, 16, 17, 18, 19, 24, 25, 29, 30).
- The document (6) has evidence of a strong relationship between time management and planning and organizing.
- The documents (1, 3, 7) have evidence of a strong relationship between human resources management, information resources management, and planning/ organizing.

**Cluster Content:** Facilitation, goal setting and management, human resources management, information resources management, manage tasks, planning and organizing skills, strategic planning, and time management

**Cluster Title:** "Planning and organizing soft skills" was chosen to be the cluster title.

The majority of the sticky notes cards were sorted into the first 10 clusters. It was found that the ones left out were from document (22). Thus, it was determined to establish two clusters: one to include all skills that are related or strongly interlock with self-intelligence, and the second one to include all skills that are related or strongly interlocked with social-intelligence.

**Cluster #11:**

The skills that refer to "*having a clear perception of self-personality and applying the behavior change tactics to produce the desired change in behavior*" were clustered together. This decision was supported by the following discovery:

- This cluster is a result of combining the self-awareness and self-management skills from the document **(**22). The skills transparency, adaptability, achievement, and initiative were excluded from this cluster. This decision was due to a stronger evidence to sort the skill transparency into prior clusters.
- The terminology self-awareness was found to be included as a stand-alone item in the content of the documents (12, 22, 23, 28). The terminology self-management was found to be included as a stand-alone item in the content of the documents (8, 8, 10, 18, 21, 22, 30).

**Cluster Content:** Accurate self-assessment, assertiveness, emotional self-awareness, enthusiasm, optimism, positive attitude, reflection, self-awareness, self-confidence, self-control, self-direction, self-esteem, self-management, self-motivation and promotion

**Cluster Title:** "Self-intelligence soft skills" was chosen to be the cluster title.

**Cluster #12:**

The skills that refer to recognizing others' feelings and knowing how to use that to help others and influence them were clustered together. This decision was supported by the following discovery:

- This cluster is a result of combining the social-awareness and relationship-management skills from the document (22). The skills organizational-awareness, service, change catalyst, conflict management, teamwork and collaboration were excluded from this. This decision was due to a stronger evidence to sort the skill transparency in prior clusters.
- The terminology social-awareness was found to be included as a stand-alone item in the content of the documents (13, 22). The terminology relationship-management was found to be included as a stand-alone item in the content of documents 20 and 22. The terminology social skill was found to be included as a stand-alone item in the content of documents (6, 7, 11, 14, 30).

**Cluster Content:** Able to lead and inspire, be responsible to others, buy in and advocacy, customer service, diplomacy, empathy, influence others, inspiring people, motivate people, persuasion, relationship management, social awareness, social skills

**Cluster Title:** "Social-intelligence soft skills" was chosen to be the cluster title.

***Grouping Reliability:***

Reliability meant repeating the categorization of skills into clusters over time produced the same results. To check the grouping reliability, two techniques were used: mind map software, and repeating the process after a period of time. The mind map software was used to repeat the categorizing backward. It offered an electronic, visual understanding of the clustering process. The twelve cluster titles were written electronically using mind map software, and then each skill was accommodated in the convenient cluster as shown in Figure 4.7. The result of this process was compared to the result of cards categorization. It was found that the manual and electronic categorizations were identical. After nine months, the same process was repeated and nothing changed.

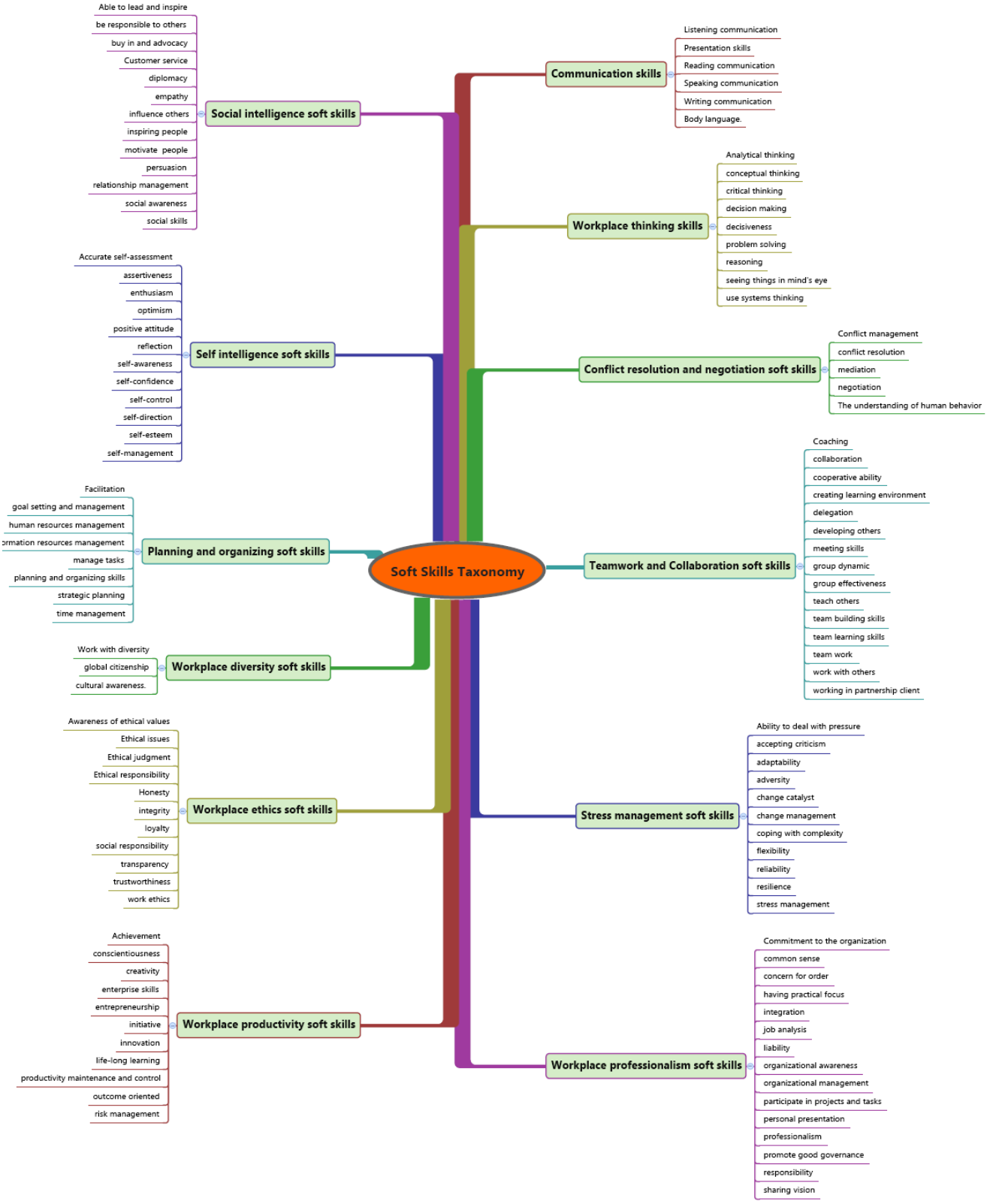



**Figure 4.7: The Soft Skills Taxonomy Using Mind Map Software**

**STEP 5: The proposed soft skills taxonomy:**

After determining the final organization for the 12 clusters, they were documented in a table that comprised the clusters Title and the content soft skills. Table (4.3), summarizes the categorization of soft skills in taxonomy:

Table 4.3:The proposed soft skills clusters

| |
|---|
| **Cluster #1: Communication skills:** Listening communication, presentation skills, reading communication, speaking communication, and writing communication |
| **Cluster #2: Workplace thinking skills:** Analytical thinking, conceptual thinking, critical thinking, decision making, decisiveness, problem solving, reasoning, seeing things in mind's eye, and use systems thinking |
| **Cluster #3: Conflict resolution and negotiation:** Conflict management, conflict resolution, mediation, negotiation, the understanding of human behavior |
| **Cluster #4: Teamwork and Collaboration skills:** Coaching, collaboration, cooperative ability, creating learning environment, delegation, developing others, meeting skills, group dynamic, group effectiveness, teach others, team building skills, team learning skills, team work, work with others, and working in partnership client |
| **Cluster #5: Stress management skills:** Ability to deal with pressure, accepting criticism, adaptability, adversity, change catalyst, change management, coping with complexity, flexibility, reliability, resilience, and stress management |
| **Cluster #6: Workplace professionalism skills:** Commitment to the organization, common sense, concern for order, having practical focus, integration, job analysis, liability, organizational awareness, organizational management, participate in projects and tasks, personal presentation, professionalism, promote good governance, responsibility |
| **Cluster #7: Workplace productivity skills:** Achievement, conscientiousness, creativity, enterprise skills, entrepreneurship, initiative, innovation, life-long learning, outcome oriented, productivity maintenance and control, and risk management |
| **Cluster #8: Workplace ethics skills:** Awareness of ethical values, ethical issues, ethical judgment, ethical responsibility, honesty, integrity, loyalty, social responsibility, transparency, trustworthiness, and work ethics |
| **Cluster #9: Workplace diversity skills:** Work with diversity, global citizenship, and cultural awareness |
| **Cluster #10: Planning and organizing skills:** Facilitation, goal setting and management, Allocate resources, information resources management, able to manage tasks, planning and organizing skills, strategic planning, and time management |
| **Cluster #11: Self intelligence skills:** Accurate self-assessment, assertiveness, enthusiasm, optimism, positive attitude, reflection, self-awareness, self-confidence, self-control, self-direction, self-esteem, self-management |
| **Cluster #12: Social intelligence skills:** Able to lead and inspire, be responsible to others, buy in and advocacy, customer service, diplomacy, empathy, influence others, inspiring people, motivate people, persuasion, relationship management, social awareness, social skills |

**STEP 6: Share and update the soft skills taxonomy:**

Up to this step, the defined soft skills taxonomy clusters were established by: combining the soft skills that existed in 23 scholarly documents, re-organizing them using the experiential knowledge of the researcher, and triangulating them using the viewpoints of the same documents' authors. That effort produced a strong taxonomy. However, further work on taxonomy validation was done prior to using it in the industry survey, as follows:

1. **Pilot Survey #1:** The defined soft skills taxonomy clusters were used to develop the industry survey instrument. The survey instrument had an open-ended question that aimed to be a validation question for the defined taxonomy clusters. The question was phrased as:

   ***Do you think that other soft skills should be highlighted in a stand-alone cluster? If so, please give us your suggestions.***

   Fifty possible respondents were recruited to participate in the survey during the "spring of 2014 career fair," organized by the department of Building Construction at Virginia Tech University. The researcher contacted them using email and asked them to respond to an online survey. Fifteen respondents completed the survey. Out of the 15 respondents, only two responded to the validation question. The feedback of the two respondents resulted in updating the soft skills taxonomy by adding the body language skill to the communication soft skills cluster. In one way or another, the other suggestions from the two respondents already existed in the same terminology or the same meaning.

2. **Open discussion with academic community:** The defined soft skills taxonomy clusters were shared with the construction academia during the ASC 2014. It was presented as a part of the pilot study (phase 1, 2 and 3 from the theoretical framework) in a poster presentation format. The researcher engaged with many experts in discussion. None of them suggested any serious changes to the taxonomy clusters.

3. **Pilot Survey #2:** The latest version from the soft skills taxonomy was used. The survey had the same validation question. Yet, a larger number of participants participated. One hundred twenty possible respondents from the construction industry were recruited from the LinkedIn website. They were invited to participate in the survey. Forty-three respondents completed the survey. Only five participants responded to the validation question. Five respondents suggested changes that had already been covered and justified in the taxonomy clusters.

**STEP 7: The proposed soft skills taxonomy to be used:**

The 53 respondents out of 60 in both pilot surveys indicated a strong level of consistency and content validity for the soft skills taxonomy. The feedback from the construction academia supported that finding, as well. Both industry and academia respondents didn't communicate any critical changes to the taxonomy clusters. Thus, the soft skills taxonomy was updated by adding the body language skill to Cluster #1: Communication skills.

Based on those findings, it was concluded that the vast majority of industry and academia respondents accepted the taxonomy clusters, and that would be the needed evidence of validity and reliability of the taxonomy to be used in the phase of the research.

### 4.3. Defining the Soft Skills Curriculum Instructional Strategies List:

The curriculum is a formal academic plan that guides the students' learning in pursuit of a college degree (DEZURE 2002) or "*the courses offered by an educational institution or a set of courses constituting an area of specialization"* Gilman (1989). The vast majority of researchers went beyond this definition. They variably used the term "curriculum" to describe guidelines that are aimed at improving learning. The curriculum research covers a very broad range of topics, methods, approaches, and theories. This could be in the form of instructional goals, content, instructional methods and resources, sequencing, evaluation, assessments, structure, and sometimes adjusting or complementing an existing curriculum (DEZURE 2002; Eash 1991; Hameyer 1991; Urevbu 1983).

In literature, there is a large number of curriculum theories that govern and unify any curriculum research. Hameyer (1991) describes (9) groups of curriculum theories that can unify any curriculum research. He argues that all theories aim to encompass the phenomena within a set of events that have a theory and contribute to the knowledge. Alternatively, they differ on how they deal with the phenomena: unify it, define a set of events, and the scope of work. The (9) groups are: conceptual model of curriculum, theories of curriculum legitimization, process theories of curriculum, structural curriculum theories, theories of curriculum implementation, the institutional curriculum, the biographical curriculum, the instructional curriculum, and the subject-matter curriculum. This research followed the instructional curriculum theory.

Accordingly, this study was unified by the structural curriculum theory (Hameyer 1991) which defines the worthwhile subject matter selection method and justifies the process. Also, it explains how to organize the meaningful knowledge within a curriculum framework so that it transforms that knowledge into rigorous and relevant quality learning activities and instructional standards that will help educators better prepare construction students for future industry career opportunities.

This section identified (8) curriculum instructional domains, and (5) alternative strategies for each domain. Curriculum instructional domains could be the methods of course delivery, course content, course structure, course assessment, instructional pedagogy, etc. The domain alternative strategies refer to the best strategies that the educator can use to implement that domain in an

efficient and effective manner. For instance, instructional pedagogy curriculum component alternatives could be problem based learning, learning by reflection, simulation learning, etc.

The following sections describe the selected domains and the alternative strategies for each one of them. They were extracted from literature documents that represent the best practices in the field. Three steps were used to develop a list of (5) soft skills instructional domains and (5) alternatives for each one of them. The three steps were:

STEP 1: Evaluate and define the source of knowledge.
STEP 2: Categorize the curriculum instructional components and its options.
STEP 3: The proposed to-be-used domains and its alternative matrix.

***STEP 1: Evaluate and Define the Source Knowledge:***

The literature that was identified to be used in this section highly focused on proposing method(s) or practice(s) to implement skills or competences in undergraduate education within or across disciplines. They represent a grassroots movement, innovations, reforms efforts, and individual initiatives in the field. They also identify patterns and themes across a wide range of skills through teaching and learning practices.

The literature was used as an example to support extracting the alternative. However, in few cases, the context of the document was used to support the rationality of picking a specific alternative.

***STEP 2: Categorizing the curriculum domains and its instructional strategies:***

Prior to collecting data for this section, the scope of work was limited in identifying (8) curriculum instructional domains and (5) instructional strategies for each domain. It is important to highlight that the vast majority of curriculum scholars agreed that (4) domains are needed to be a part of any good curriculum. Those (4) are: method of course delivery, pedagogical approach, course assessment, and course feedback (Eash 1991). On the contrary, the other (4) instructional domains were less regarded or scarcely existed in curriculum research; however, some of the scholars argued that they would be very important for succeeding in the curriculum implementation. Those (4) are: students' academic level, learning resources, class environment, and educator experience. The following were the (8) domains summary. For each domain, the source of knowledge and the (5) instructional alternatives were documented.

***Method of course delivery:***

This domain defined how to present the course for learners. There was an abundance of literature examples that addressed the method of course delivery. The following is a summary for five methods of course delivery alternatives to be used in the research:

**Online class:** This is a stand-alone course in which instruction is provided entirely through the school's chosen Learning Management System. No on-site class meetings.

***Literature source:***

- *Blended learning and flipping the construction management classroom for improved teaching and management classroom for improved teaching and learning (Rogers and Tingerthal 2014).*
- *Self-driven co-curricular activities: a subtle way to enhance students' soft skills (Selamat et al. 2013).*

**Face to Face (Stand-Alone) Class:** This is a stand-alone course in which instruction is delivered fully on-site with face-to-face interaction between the instructor and student. Another name for this method of course delivery is in-class work. Sometimes, a portion of the course instruction is delivered online and a portion is delivered on-site face-to-face. The course uses the institution's chosen Learning Management System for the online portion of the course. Usually, the online resources are aimed to support the course's needed pedagogy and assessment feedback needs. Other names for this method of course delivery are blended learning or class and web enhanced class.

**Literature source:**

- *Blended learning and flipping the construction management classroom for improved teaching and management classroom for improved teaching and learning (Rogers and Tingerthal 2014).*
- *Self-driven co-curricular activities: a subtle way to enhance students' soft skills (Selamat et al. 2013).*
- *Designing leadership and soft skills in educational games: the e-leadership and soft skills educational games design model (Freitas and Routledge 2013).*

**Integrated in Curriculum:** A method of course delivery that implements said skills within a certain class in parallel with other non-technical objectives. The class is an opportunity that allows the student to indirectly practice and demonstrate said skills.

**Literature source:**

- *Vertically integrating a capstone experience: A Case Study for a New Strategy (Mills and Beliveau 1999).*
- *Design and Implementation of a Capstone Course to Satisfy the Industry Needs of Virtual Product Development and ABET Engineering Criteria (Omar 2014).*

**Learning contract class:** A method of course delivery that requires a form of agreement between the student and his assigned supervisor. The agreement allows the students to plan, implement, and assess their own achievement. It covers the activities and/or projects that the

students should have learned during a specific time. The student is responsible for the planning and carrying out of all activities/projects as mutually agreed upon with the supervisor.

**Literature Source:**

- *Self-driven co-curricular activities: a subtle way to enhance students' soft skills (Selamat et al. 2013).*

**Accelerated class:** This is a stand-alone course in which the course is delivered in a compressed time and either meets more often to ensure adequate contact time or utilizes other proven accelerated learning methods to replicate the required contact hours. The course may be offered in the form of face-to-face, online, or as a hybrid class. Other names for this method of course delivery are short course and certification.

***Literature Source:***

- *Project Managers – Do They Need (McHugh and Hogan 2009).*
- *Project Management Competence for the New Millennium (Crawford 2000).*
- *The Hard Case for Soft Skills (Caudron 1999).*

***The Pedagogical Approach:***

Recent scholarly publications started promoting using the pedagogical approach as a state of the art solution for skills of education. The educator uses pre-defined pedagogical settings as a framework to develop the course content and manage its learning activities. The pedagogical approach has two main categories. The first one is passive learning. The second one is active learning. Active learning is "anything that involves students in doing things and thinking about the things they are doing" (Bonwell & Eison, 1991, p. 2). The following is a summary for five pedagogical approach alternatives to be used in the research:

**Traditional education:** A passive conventional educational process in which the teacher is the center of teaching. This education usually uses the traditional lecturing style, assessment, and feedback.

**Literature Source:**

- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*

**Role playing Simulation-based learning:** An active experiential learning process by which the learner cultivates knowledge by using an artificial representation of a real world process.

**Literature Source:**

- *Simulation-based Learning for Conveying Soft-Skills to XL-Classes (Janßen et al. 2014).*
- *Teaching Computer Science Soft Skills as Soft Concepts (Hazzan and Har-Shai 2013).*
- *Integrating Soft Skills Through Active Learning In The Management Classroom (Nealy 2011).*
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*

**Problem/ project based learning:** A student-centered pedagogy in which students learn about a subject through the experience of problem solving. Students learn both thinking strategies and domain knowledge.

**Literature Source:**

- *Problem-based learning: What and how do students learn? (Hmelo-Silver 2004).*
- *The effect of problem/project-based learning on a desired skill set effective (Sirotiak 2008).*
- *Teaching Computer Science Soft Skills as Soft Concepts (Hazzan and Har-Shai 2013).*
- *Improving Student Confidence and Ability To Cope Under Stress Through Project Based Learning (Sirotiak and Walters 2009) .*

**Reflection learning:** Research shows peer teaching is an active learning strategy that results in significant gains in learning. Students practice professional roles and improve communication skills.

**Literature Source:**

- *Developing and Assessing Work Readiness using Reflective Practice (Mills 2013).*
- *Teaching Computer Science Soft Skills as Soft Concepts (Hazzan and Har-Shai 2013).*

**Game-based learning:** Training and educational tools for motivating and engaging learners, and reaching hard-to-reach learner groups.

**Literature Source:**

- *Designing leadership and soft skills in educational games: the e-leadership and soft skills educational games design model (Freitas and Routledge 2013).*
- *Integrating Soft Skills Through Active Learning In The Management Classroom (Nealy 2011).*

***Course Assessment (Grading):***

This domain defined the vast majority of education. Scholars indicate that course assessment might be one of the most critical points that contribute to achieving higher outcomes among students *(Pulko and Parikh 2003) (Mills 2013) (Mills and McLaughlin) (Hazzan and Har-Shai 2013) (Sirotiak and Walters 2009)*. The following is a summary for five course assessment alternatives to be used in the research:

**Presentations:** Using the students' oral presentations' ability to grade them.

**Literature Source:**
- *Developing and Assessing Work Readiness using Reflective Practice (Mills 2013).*
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*

**Portfolios reports:** A collection of artefacts that cover a set of skills and can be used as a grading tool. It can include performance evaluations that include highlights of students' skills and accomplishments, skill or interest summaries that students have received from completed self-assessments, and works in progress and records of involvement.

**Literature Source:**
- *Evaluation of Graduate Learning Outcomes Using Constructive Alignment in Australia (Mills and McLaughlin).*
- *Digital portfolios: capturing and demonstrating skills and levels of performance (Weihrich and Koontz 2005).*

**Self-assessment and peer-assessment:** Involving the students in the assessment process. The assessment criteria can be developed by the students or instructor, yet it will be conducted by the student.

**Literature Source:**
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*

**Assignments, reports, and projects:** This can be done as per the traditional education.

**Literature Source:**
- *Teaching Computer Science Soft Skills as Soft Concepts (Hazzan and Har-Shai 2013).*
- *Developing and Assessing Work Readiness using Reflective Practice (Mills 2013).*
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*

**Online tools:** Using websites that offer trusted tools to evaluate the respondent/user's one soft skill or a group of skills.

**Literature Source:**
- *Online tool for soft skills evaluation and employee management (Pop 2014).*
- *Improving Student Confidence and Ability To Cope Under Stress Through Project Based Learning (Sirotiak and Walters 2009).*
- *The Hard Case for Soft Skills (Caudron 1999).*

***Course Feedback:***

The course feedback is the method of gathering feedback information from the students. The feedback could be related to the learning expectation, instructional methods, learning outcomes, pedagogies, etc. The gathered information aimed to improve the course curriculum. The following is a summary for five course feedback alternatives to be used in the research:

**Course blog:** Developing a webpage that uses a blog templet. The students use that webpage to reflect on the course. It offers a feedback during the class permanence.

**Literature Source:**

- *Using Blogs to Stimulate Reflective Thinking in a Human Behavior Course (Chaumba 2015).*

**Formal university student feedback process:** A paper-based or electronic feedback form that is predesigned by the department or school to collect feedback from students. Usually it is a standard form that serves all courses at the university.

**Literature Source:**

- *Soft or hard boiled: Relevance of soft skills for IS professionals (Snell et al. 2002).*

**End of course discussion:** Asking the students to reflect on their learning outcomes and achievements compared with their course expected outcomes.

**Course wiki:** Collaborative webpage that belongs to the course, where all students and educators have equal ability to make changes to the content.

**Course forum:** Collaborative webpage that belongs to the course, and is designed as a part of the learning management system. It helps in getting feedback from students and makes them interact so they can share their experiences about the course.

***Student academic level:***

The student academic level describes the number of units/courses an undergraduate student has completed up to date. Also, it takes into consideration those units/courses currently in progress. Reviewing the literature documents revealed a small number of papers that partially highlights the students' academic level as an important element during soft skills teaching. Therefore, the options for this domain were the four academic levels that were used by the majority of the US construction schools. Accordingly, the fifth one was the mixed level. The following is a summary for five student academic level alternatives to be used in the research:

**Literature Source:**

- *The role of hard and soft skills on engineering education (Martins et al. 2007).*
- *Student perceptions of cultural competence content in the curriculum (Brennan and Cotter 2008).*
- *Integrating Soft Skills Through Active Learning In The Management Classroom (Nealy 2011).*

For this domain, the researcher defined five options that are:

**Freshman Level:** Only first year students in the undergraduate program

**Sophomore Level:** A second-year student in the undergraduate program

**Junior Level:** A third year student in the undergraduate program

**Senior Level:** A fourth year student in the undergraduate program

**Mixed Level:** Two levels or more

***Course learning resources:***

This domain defined the options of course learning resources (material). The learning resources are a very important aspect that can contribute to the soft skills cultivation among students (Núñez Pardo and Téllez Téllez 2009). The following is a summary for five course learning resource alternatives to be used in the research:

**Handouts Material:** Learning artifacts developed by the instructor and given to the students in a form of printed documents or electronic documents. This includes notes, presentations, articles, etc.

**Literature Source:**

- *Designing leadership and soft skills in educational games: the e-leadership and soft skills educational games design model (Freitas and Routledge 2013).*
- *Integrating Soft Skills Through Active Learning In The Management Classroom (Nealy 2011).*
- *Preparing Instructional Objectives and Educational Goals for Construction Management Courses (Adcox Jr 2003).*
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*
- *Enrichment and supplementary materials (Thomas 1991).*
- *Assessing the effectiveness of Problem Based Learning (PBL) using Quality Function Deployment (QFD): Students Perspective (Mohd Rohani et al. 2005).*

**Manual book(s):** It is a book that details the required course content and explains how to articulate the content into practice. Another name for a manual book is handbook.

**Literature Source:**

- *Accommodating soft skills in software project management (Sukhoo et al. 2005).*

**Text Book(s):** Using a specific book(s) as a standard for the research of soft skills.

**Literature Source:**

- *Textbooks (Westbury 1990).*
- *Assessing the effectiveness of Problem Based Learning (PBL) using Quality Function Deployment (QFD): Students Perspective (Mohd Rohani et al. 2005).*

**Case Studies:** Developing case studies as a learning resource.

**Literature Source:**

- *Fostering deep and elaborative learning and generic (soft) skill development: the strategic use of case studies in accounting education (Boyce et al. 2001).*
- *Assessing the effectiveness of Problem Based Learning (PBL) using Quality Function Deployment (QFD): Students Perspective (Mohd Rohani et al. 2005).*

**Learning Management System:** Using the institution software/website that is often designed to organize and facilitate the electronic course material, assignments, discussions, and many other instructional objectives.

**Literature Source:**

- *Designing leadership and soft skills in educational games: the e-leadership and soft skills educational games design model (Freitas and Routledge 2013).*

***Classroom size and layout:***

This domain defined the physical environment of the class. Few researchers argue that the class size and set up can affect the student achievement (Toth and Montagna 2002). (Kennedy and Siegfried 1997) argue that small-class discussion methods are better in teaching problem solving, critical thinking, motivating others, etc. In traditional classes, seats are often arranged in rows facing the instructor, while active learning approaches demand a more flexible vision for the students so that they can collaborate with their classmates. The following is a summary for five classroom sizes and layout alternatives to be used in the research:

***Literature Source:***

- *Simulation-based Learning for Conveying Soft-Skills to XL-Classes (Janßen et al. 2014).*
- *Assessing the effectiveness of Problem Based Learning (PBL) using Quality Function Deployment (QFD): Students Perspective (Mohd Rohani et al. 2005).*
- *Teaching 'soft' skills to engineers (Pulko and Parikh 2003).*
- *Assessing the effectiveness of Problem Based Learning (PBL) using Quality Function Deployment (QFD): Students Perspective (Mohd Rohani et al. 2005).*

For this domain, the researcher defined five options that are:

**Over size class:** The class that contains more than 25 students

**Regular class:** The class that contains 20-25 students

**Small class:** The class that contains less than 20 students

**One cluster setting:** The class seats are arranged in a circle, semi-circle, or u-shape setting to create one large group arrangement

**Small clusters setting:** The class seats are arranged around table-stations.

***Instructor(s) background:***

It is the educator who interprets and shapes the best way for soft skills adaptation in the classroom. This domain was proposed by the researcher to determine the best characteristics of the educator. The researcher proposed five major characteristics which are: single instructor from academia, group of instructors from academia, speakers from industry, instructor from industry, and hybrid instructors. The following is a summary for five instructor(s)' background alternatives to be used in the research:

***Literature Source:***

- *Developing Construction Professionals of the 21st Century: Renewed Vision for Leadership (Toor and Ofori 2008).*
- *Bringing Industry to the Classroom (Hoachlander 2008).*

For this domain, the researcher defined five options that are:

**Competent instructor from academia:** This means that the course should be facilitated by the instructor alone.

**Group of instructors from academia:** This means that the course should be facilitated by two instructors or more from academia.

**Speakers from industry:** This means that the course should be facilitated by the instructor and industry speakers.

**Trainers from industry:** This means that the course should be facilitated by the instructor and training experts from industry.

**Instructor from academia with industry experience:** This means that the course should be facilitated by the instructor, speakers from industry, and training experts.

***STEP 3: The proposed to-be-used domains and its instructional strategies list:***

As a result to the previous work, Table 4.4 represents the soft skills domains and its instructional strategies that will be used in the next phases.

**Table 4.4: The curriculum domains and alternatives**

| # | Curriculum Domain | Alternatives |
|---|---|---|
| **D#1** | **Method of course delivery:** | Online class, stand-alone, integrated in curriculum, learning contract class, and accelerated class. |
| **D#2** | **The Pedagogical Approach:** | Traditional education, roll playing simulation-based learning, problem/ project based learning, reflection learning, and game-based learning. |
| **D#3** | **Course Assessment:** | Presentations, portfolios reports, self-assessment and peer-assessment, online tools, and 'assignment, report, and project' |
| **D#4** | **Course Feedback:** | Course blog, formal university student feedback process, end of course discussion, course wiki, and course forum. |
| **D#5** | **Student academic level:** | Freshman level, sophomore level, junior level, senior level, and mixed level: two levels or more. |
| **D#6** | **Course Learning resources:** | Handouts material, manual book(s), text book(s), case studies, and learning management system. |
| **D#7** | **Classroom size and layout:** | Over size class, regular class, small class, one cluster setting, and small clusters setting. |
| **D#8** | **Instructor(s) background:** | Competent instructor from academia, group of instructors from academia, speakers from industry, trainers from industry, and instructor from academia with industry experience. |

## 4.4 Summary:

This chapter has two major outcomes, the 12 soft skills clusters taxonomy and the list of instructional strategies. Both outcomes were the base for the next phases of the theoretical framework tasks.

# CHAPTER 5: THE MEASURE PHASE

## 5.1 Introduction:

This chapter discusses in detail the second phase of the proposed theoretical framework: The Measure Phase. The objectives of this phase are:

- Benchmark the current actual performance of the soft skills taxonomy among construction graduates.
- Measure the relationship between the soft skills taxonomy and the list of curriculum instructional strategies.

To achieve these objectives, two data collection methods were used: the industry survey and the structured interview.

The two data collection methods were conducted simultaneously. The industry survey used an online instrument to collect input from industry experts. The structured interview used a paper-based spreadsheet form to collect input from academia experts in teaching soft skills.

Following the introduction, the chapter has two main sections: the industry survey and the structured interview. The industry survey section starts with summarizing the survey results and highlighting the major output from the survey which is a list of the 12 soft skills clusters (+ overall soft skills) with the importance and satisfaction scores. Then it describes the instrument design, respondents' population, sampling technique, respondents' rating scale, survey procedure, the survey statistical significance, respondents' characteristics, and the survey instrument validity and reliability.

The structured interview section starts with summarizing the interviews' results which is a weighted matrix between each soft skills cluster (12 clusters) and each instructional strategy (40 strategies). The section then discusses the design of the instrument, respondents' population, sampling technique, respondents' rating scale, and interview procedure.

The highlighted area in Figure 5.1 illustrates the scope of this chapter within the proposed theoretical framework.

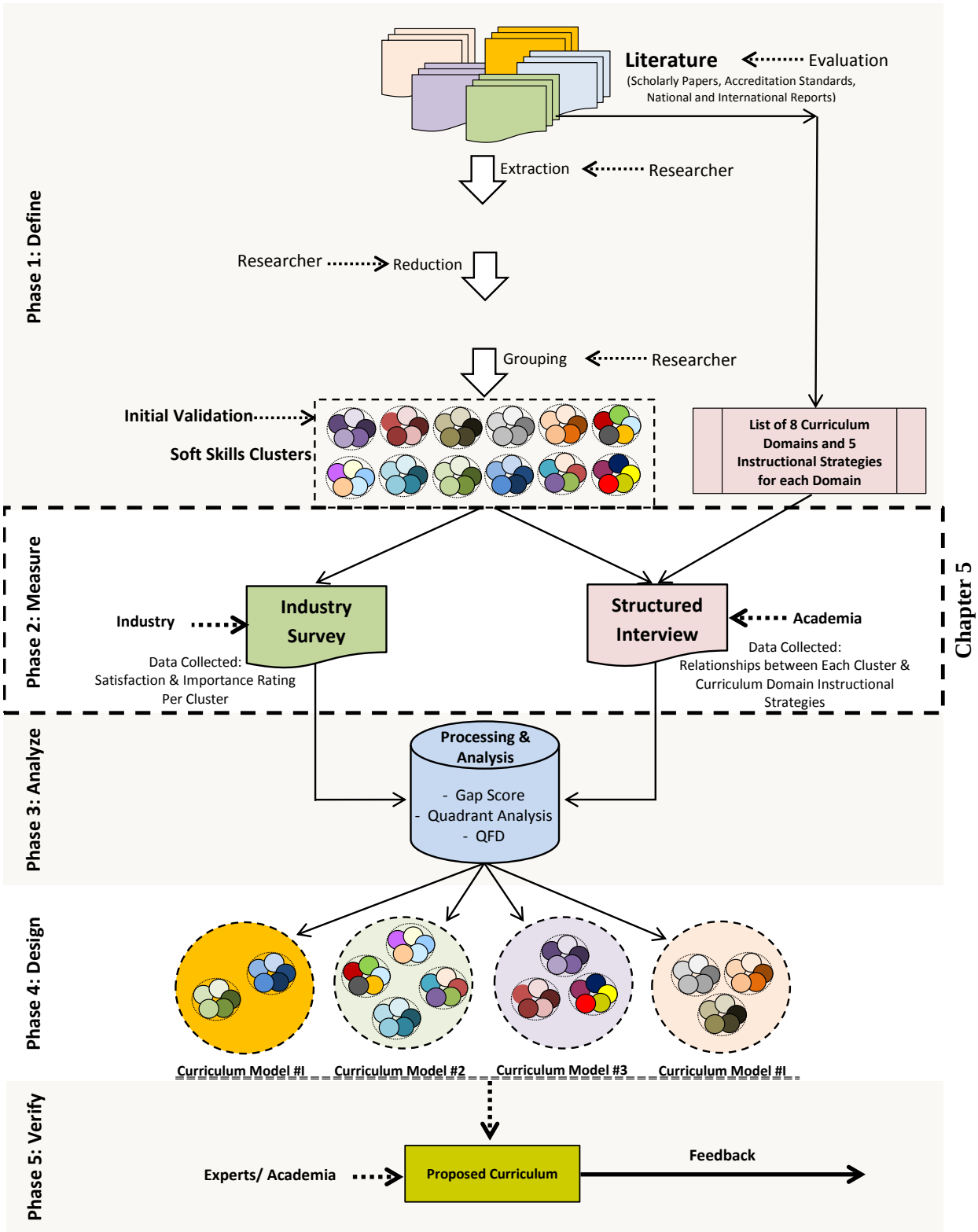



**Figure 5.1: The scope of chapter 5 within the proposed theoretical framework**

## 5.2 The Industry Survey:

The survey addressed the research problem "*Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap*." The survey collected input from construction industry experts regarding relative importance of the soft skills clusters and their rates of satisfaction of soft skills among construction graduates in an entry level position. This input offered the needed data to benchmark the level of the 12 soft skills clusters among construction graduates.

The industry survey was conducted using an online tool (https://virginiatech.qualtrics.com). Respondents were screened to identify likely construction experts using the LinkedIn website (https://www.linkedin.com/) as a source of information.

### The Industry Survey Results:

The rate of Satisfaction and the rate of Importance for the 12 soft skills clusters were the major data collected. Importance scores varied from 4.48 to 3.62 for the 12 clusters. The overall soft skills Importance score was 4.18. On the other hand, the Satisfaction scores were varied from 2.87 to 3.44 for the 12 clusters. The overall Satisfaction score was 3.21. Table 5.1 indicates the Mean values of respondents' scores for both the Importance and Satisfaction.

**Table 5.1: The survey results**

| Code | **Cluster** | **Importance Mean** | **Satisfaction Mean** |
|---|---|---|---|
| C1 | **Communication skills** | 4.48 | 3.23 |
| C2 | **Workplace thinking skills** | 4.45 | 3.34 |
| C3 | **Conflict resolution and negotiation skills** | 4.14 | 2.87 |
| C4 | **Teamwork and collaboration skills** | 4.15 | 3.30 |
| C5 | **Stress-management skills** | 4.09 | 3.06 |
| C6 | **Workplace professionalism skills** | 4.12 | 3.22 |
| C7 | **Workplace productivity skills** | 4.03 | 3.25 |
| C8 | **Workplace ethics skills** | 4.40 | 3.44 |
| C9 | **Workplace diversity skills** | 3.62 | 3.38 |
| C10 | **Planning and organizing skills** | 4.25 | 3.26 |
| C11 | **Self-intelligence skills** | 3.98 | 3.29 |
| C12 | **Social intelligence skills** | 3.95 | 3.12 |
| **OA** | **Overall 12 Clusters** | 4.18 | 3.21 |

Note: n = 306. Values are based on a scale where 1 = "very low", 2 = "low", 3 = "average", 4 = "high", and 5 = "very high."

The following were basic inferences from the industry survey data:

**Level of Importance:**
The importance mean values for the 12 soft skills clusters with respect to the respondents' career needs were plotted using a bar chart after sorting the values from the highest to the lowest, as shown in Figure 5.2. The survey result indicates that the top three most important soft skills clusters are:

1. Communication skills.
2. Workplace thinking skills.
3. Workplace ethics skills.

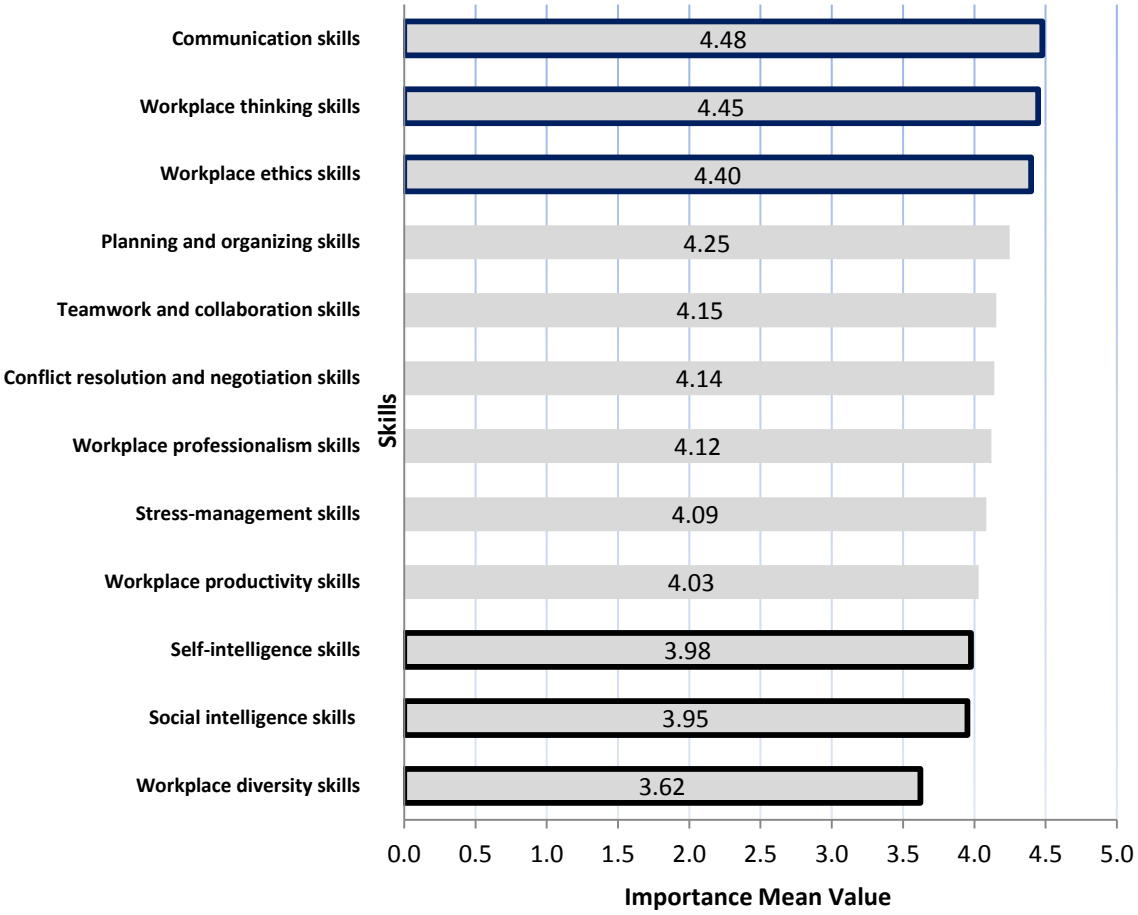



**Figure 5.2: The 12 clusters ranking based on the respondents' importance rating**

On the other hand, the survey results show that the three least important soft skills clusters are:

1. Workplace diversity skills.
2. Social-intelligence skills.
3. Self-intelligence skills.

**Level of Satisfaction:**

The satisfaction mean values for how satisfied the respondents are with their entry-level employees' ability to apply the skills within the cluster(s) on the job were plotted in a bar chart after sorting the values from the highest to the lowest, as shown in Figure 5.3. The survey results show that the top three soft skills clusters with the highest satisfaction score are:

1. Workplace ethics skills.
2. Workplace diversity skills.
3. Workplace thinking skills.

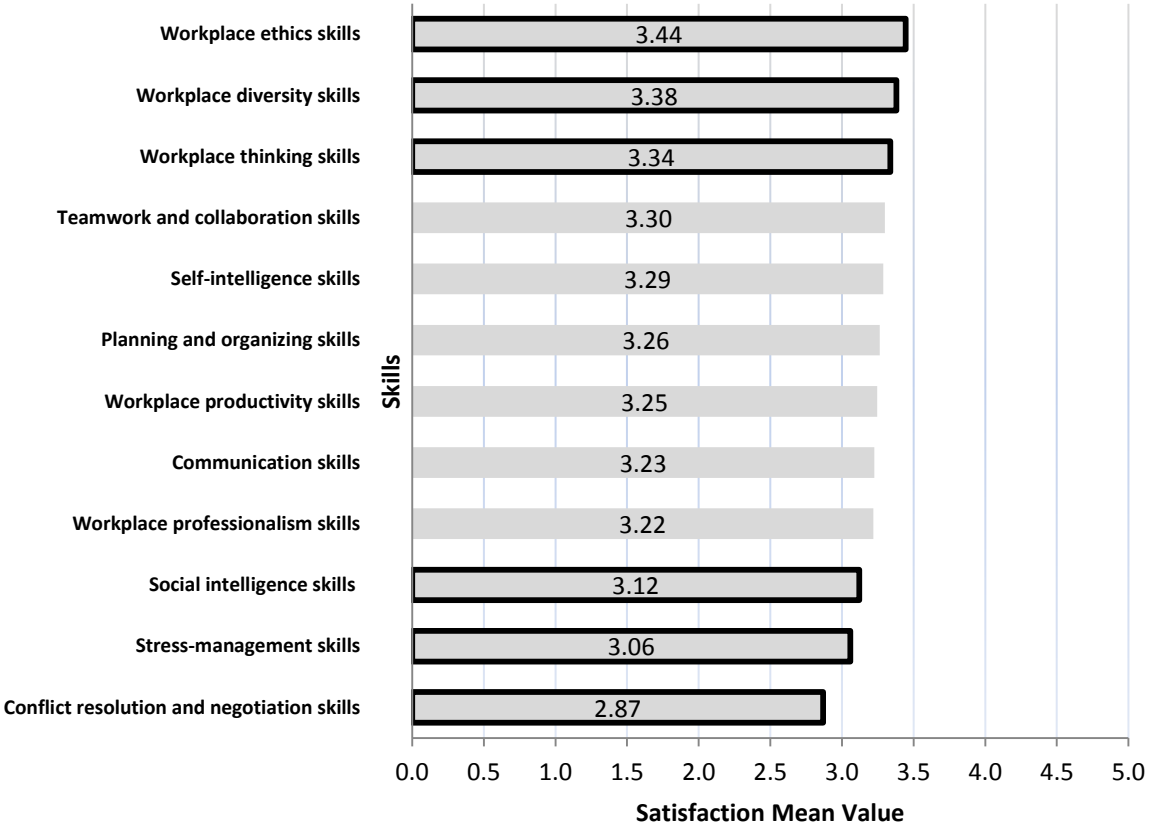



**Figure 5.3: The 12 clusters ranking based on the respondents' satisfaction rating**

On the other hand, the three soft skills clusters with the least satisfaction score are:

1. Conflict resolution and negotiation skills.
2. Stress-management skills.
3. Social-intelligence skills.

**Measured Gaps Between Importance and Satisfaction:**

The Mean values of respondents' scores for Importance and Satisfaction for the 12 soft skills clusters were plotted using a Web Rader chart type. As shown in Figure 5.4, the smallest gap between satisfaction and importance existed in the Workplace Diversity Skills cluster. On the other hand, the largest gap existed in the Conflict Resolution and Negotiation skill cluster.

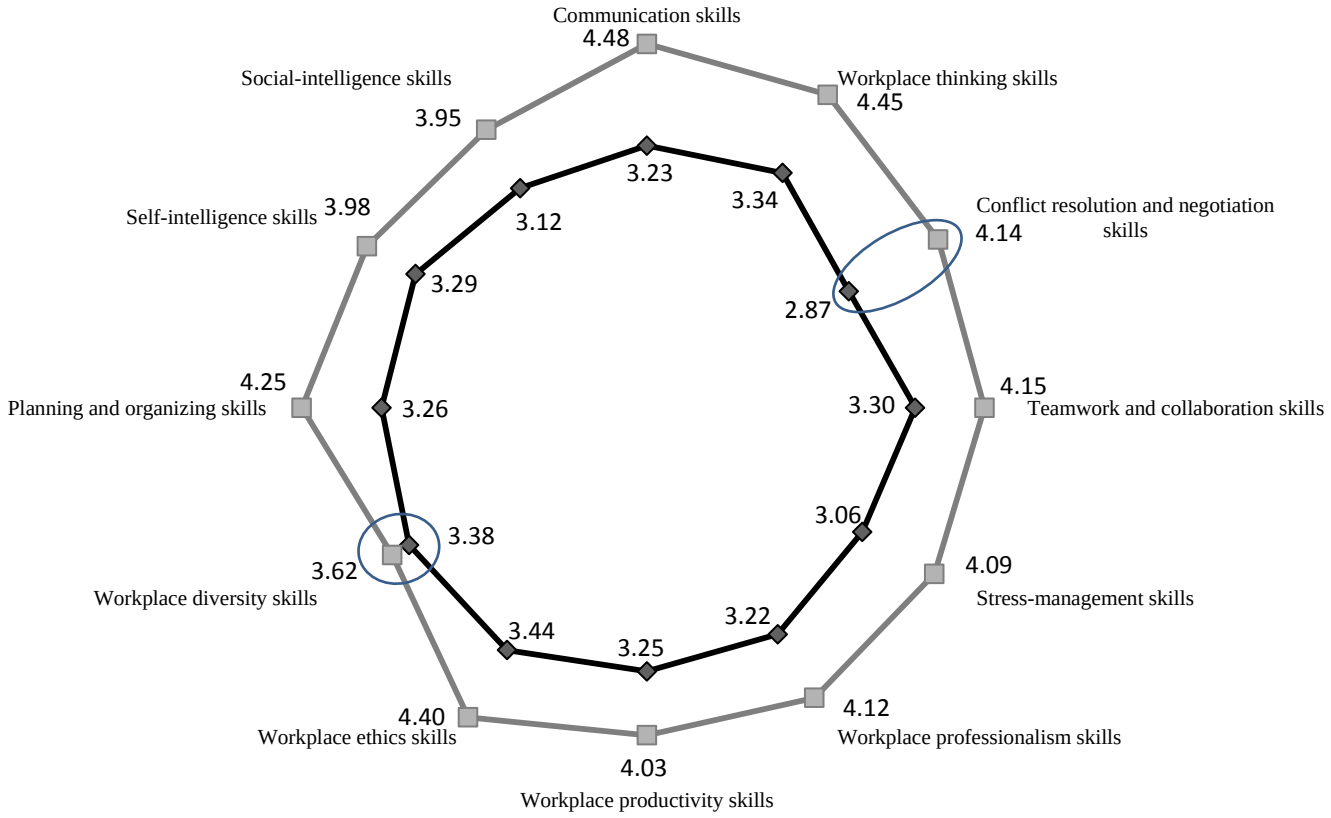



**Figure 5.4: Representation of the Satisfaction/ Importance values (The darker line represents the satisfaction values)**

Further discussion on soft skills gap will be followed in chapter 6, section 6.2.

**Instrument Design:**

As previously discussed in chapter 3, the survey instrument applied the concept of measuring the performance gap utilized from service quality (SERVQUAL) model (Zeithaml et al. 1990). The SERVQUAL experts developed the basic principles on how to design, conduct the survey, and how to analyze its findings. Also, they used statistical analysis to check the data quality. The survey instrument acknowledged all those principles.

The survey instrument was developed using the "Qualtrics" online survey software solutions (https://virginiatech.qualtrics.com). It consists of 15 questions grouped into three areas as follows:

- The first 13 questions focused on requesting input on rating the level of the respondents' relative importance of each soft skills cluster (as expectation), and how satisfied they are with their entry-level construction graduates' ability to apply and exercise the skills on the job (as Performance). The first 12 questions covered the 12 soft skills clusters. The 13th question requested input on the overall soft skills field.

  An introduction statement was included to explain the process as shown in Figure 5.5.

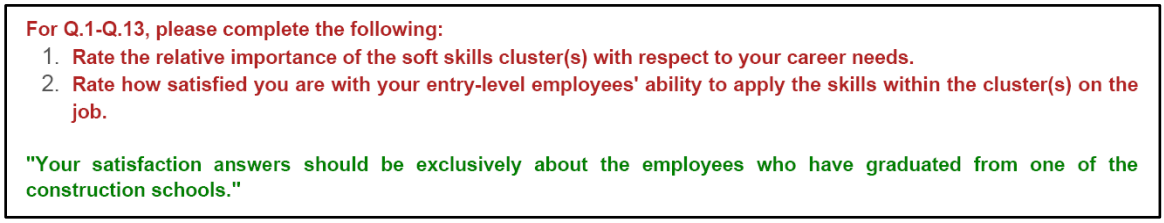



**Figure 5.5: The introductory statement**

The 13 questions used the same structure and the same scale (i.e. Likert scale). Each question differs from the others in the cluster number, title, and content. The questions were as follows:

Q#1: As shown in Figure 5.6, this question addressed Cluster #1: The Communication soft skills cluster.

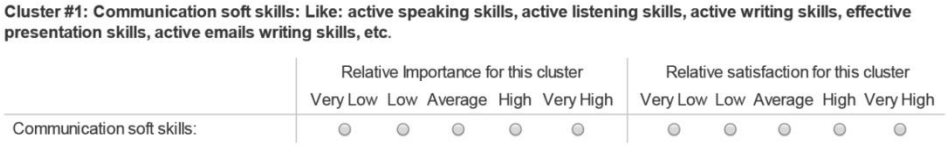



**Figure 5.6: Questions #1**

Q#2: As shown in Figure 5.7, this question addressed Cluster #2: Workplace thinking skills cluster.

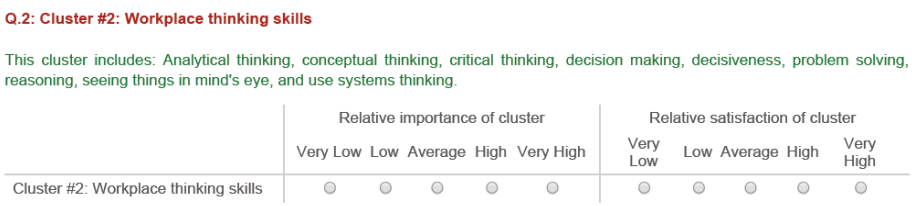



**Figure 5.7: Question # 2**

Q#3: As shown in Figure 5.8, this question addressed Cluster #3: Conflict resolution and negotiation skills cluster.

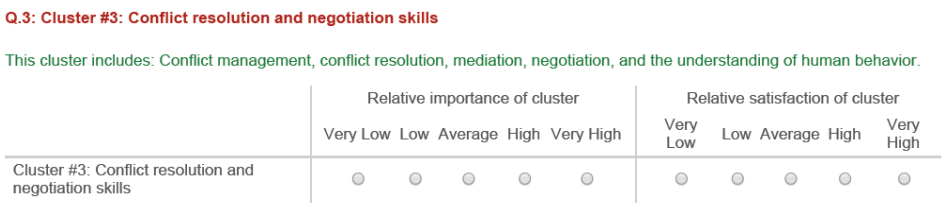



**Figure 5.8: Question #3**

Q#4: As shown in Figure 5.9, this question addressed Cluster #4: The Communication soft skills cluster.

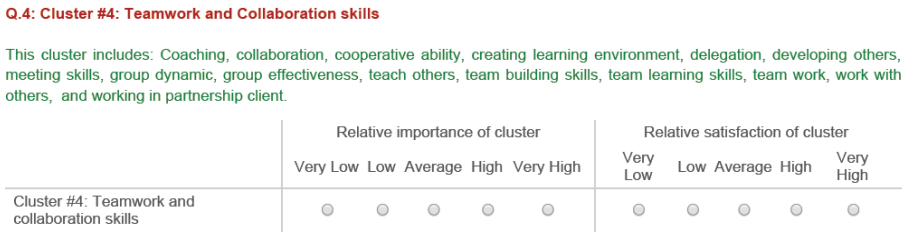



**Figure 5.9: Question #4**

Q#5: As shown in Figure 5.10, this question addressed Cluster #5: Stress-Management skills cluster.

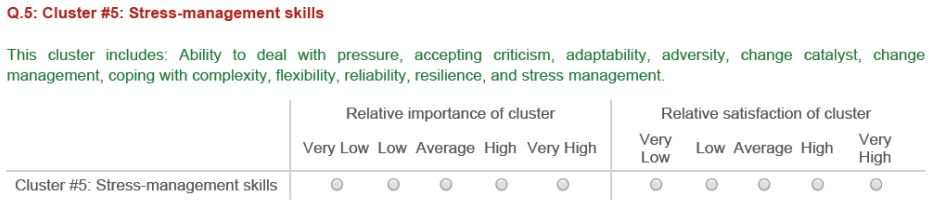



**Figure 5.10: Question #5**

Q#6: As shown in Figure 5.11, this question addressed Cluster #6: Workplace Professionalism skills cluster.

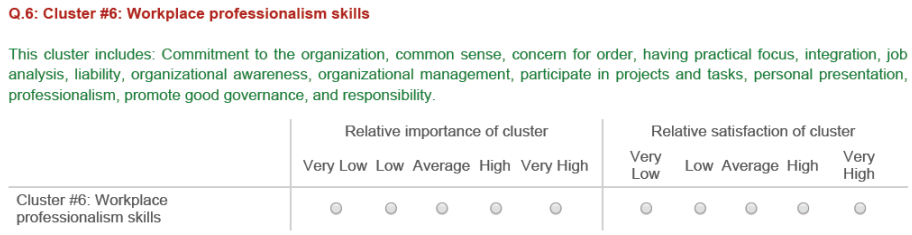



**Figure 5.11: Question #6**

Q#7: As shown in Figure 5.12, this question addressed Cluster #7: Workplace Productivity skills cluster.

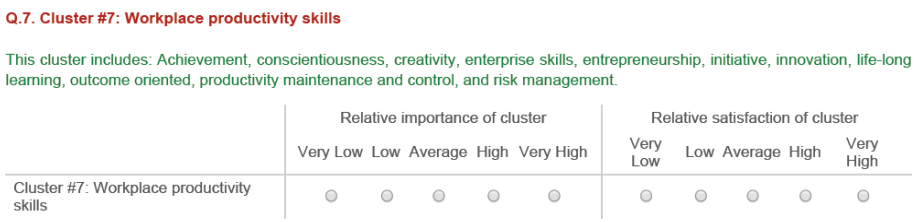



**Figure 5.12: Question #7**

Q#8: As shown in Figure 5.13, this question addressed Cluster #8: Workplace Ethics skills cluster.

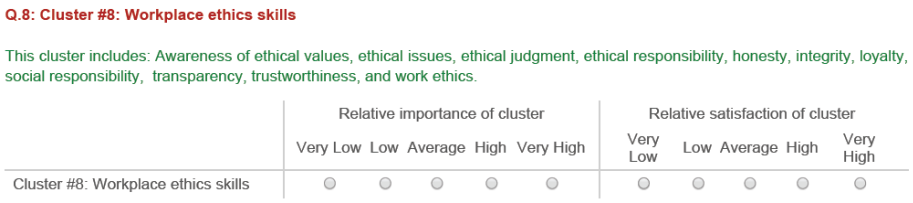



**Figure 5.13: Question #8**

Q#9: As shown in Figure 5.14, this question addressed Cluster #9: Workplace Diversity soft skills cluster.

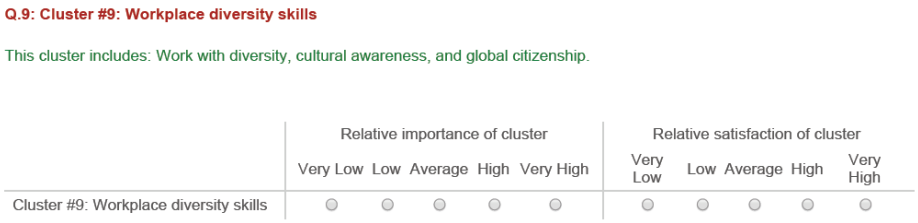



**Figure 5.14: Question #9**

Q#10: As shown in Figure 5.15, this question addressed Cluster #10: Planning and organizing skills cluster.

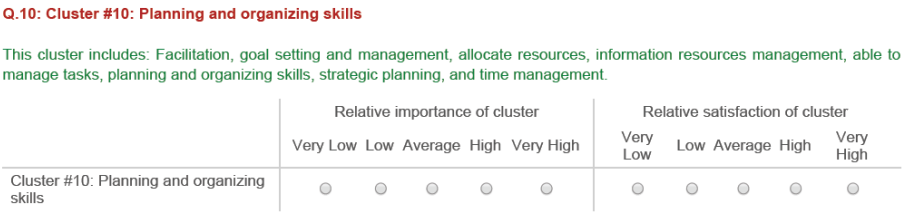



**Figure 5.15: Question #10**

Q#11: As shown in Figure 5.16, this question addressed Cluster #1: Self Intelligence skills cluster.

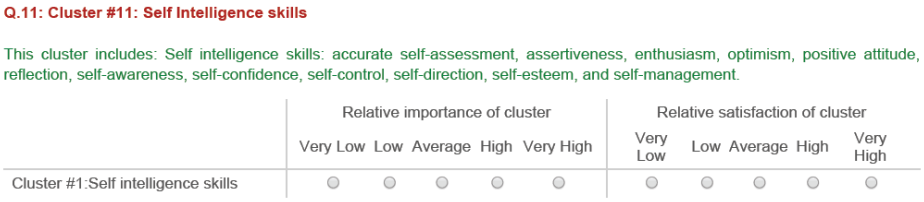



**Figure 5.16: Question #11**

Q#12: As shown in Figure 5.17, this question addressed Cluster #12: Social Intelligence skills cluster.

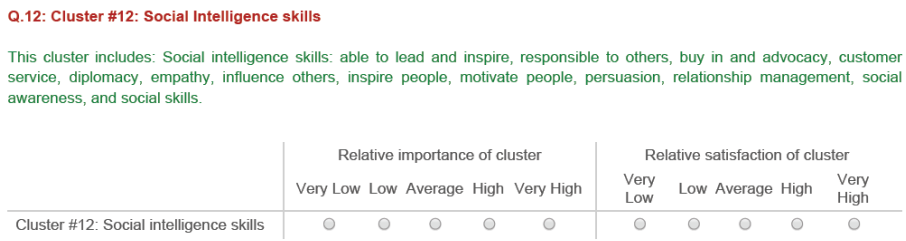



**Figure 5.17: Question #12**

Q#13: As shown in Figure 5.18, this question addressed the overall soft skills clusters.

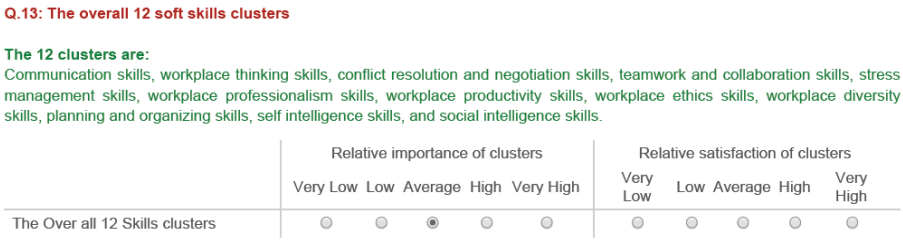



**Figure 5.18: Question #13**

- The 13 questions were followed by a Y/N question requesting the respondent's input on his agreement to the 12 clusters definitions and content. If the respondent answered "no", a secondary question requested his input on adding/defining additional cluster(s), and on adding/defining what skills might be included in this new cluster(s). Figure 5.19 denotes the question #14.

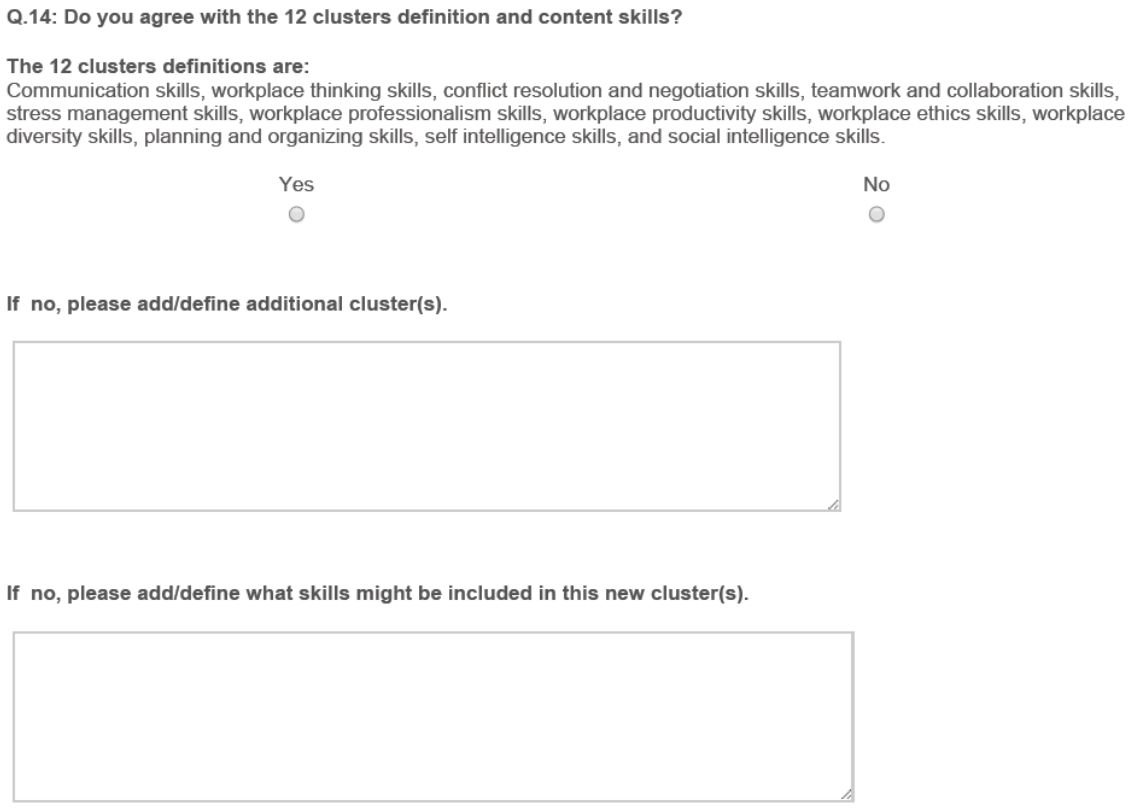



**Figure 5.19: Example from the Survey Questions #14**

- A set consisting of seven questions focused on capturing demographic information. These are: gender, age, primary job function, experience, geographical distribution, type of organization, and the size of the organization.

**Respondents' Population:** The population for this survey included construction professionals in a position to assess soft skills among construction graduates regardless of their positions or backgrounds.

**Sampling Technique:** The research used a stratified random sampling method. The construction professionals with LinkedIn accounts were used as a stratified list from the population. In order to identify the sample, the researcher conducted a search on the LinkedIn website (www.linkedin.com) using the word "Construction" as an affiliation and the filter "USA" as a location. This resulted in 4.8 million possible professional respondents in the United States who have a LinkedIn page. The first 4000 were contacted by the researcher asking to connect with them. The research screened and identified 1200 professionals as possible respondents.

**Respondents Rating Scale:** Likert scale was used. Participants were asked to rate the importance and satisfaction using one of the following expressions (Very Low, Low, Average, High, and Very High). During the data analysis, the rating was converted so that a 5 equaled a response of Very High, a 4 equaled a response of High, a 3 equaled a response of Average, a 2 equaled a response of Low, and a 1 equaled a response of Very Low.

**Survey Procedure:** A draft survey was developed and launched online using "Virginia Tech Qualtrics" website (https://virginiatech.qualtrics.com). Prior to the formal implementation of the survey, two experts were consulted to ensure the quality of the survey, and it was updated based on their feedback. The survey was then tested in a pilot administration. A LinkedIn Inmail recruitment email was sent to each possible respondent and a follow up was conducted to each one of them after four weeks. This resulted in 306 respondents who completed the survey.

**The Survey Statistical Significance:** With a population of more than 4.8 million possible participants and the confidence level of 95%, the results have a confidence interval (margin of error) of plus or minus 5.6 percentage points.

**Participants Characteristics:** The survey was sent to 1200 possible participants. Three hundred and six participants completed the core 12 questions (the important/ satisfaction questions), with a response rate of 25.5%. All of them had completed the first set of questions; however, a few of the participants didn't answer the demographic questions. The participants have a strong approximation to the population in terms of gender, age, experience, positions, type of their organization, size of their organization, and geographical location.

The following is a summary of the participants' characteristics. **N** represents the number of participants who completed a particular survey question.

a) **Respondents' Gender:** As shown in Figure 5.20, 11% of the respondents were females and 89% of them were males. This indicated a strong approximation to the actual percentage of females and males in the construction profession which is 9% and 91% as reported recently by the Bureau of Labor Statistics ((http://www.bls.gov/), extracted on 9/18/2015).

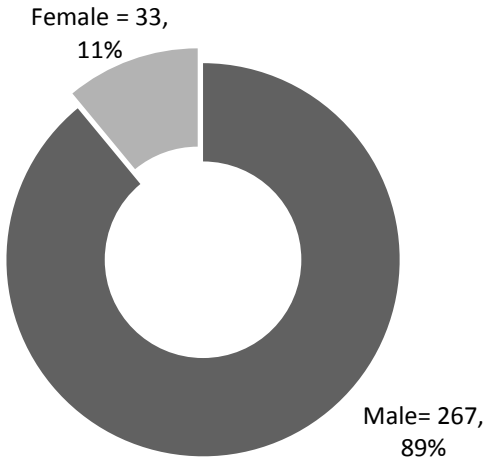



**Figure 5.20: The Participants gender, N = 300**

**b) Respondents' Age Groups:** As indicated in Figure 5.21, the respondents' age was distributed fairly among all categories. Given that more than 85% of them were above 35 years old reflects the respondents' ability to rate soft skills of the entry level employees.

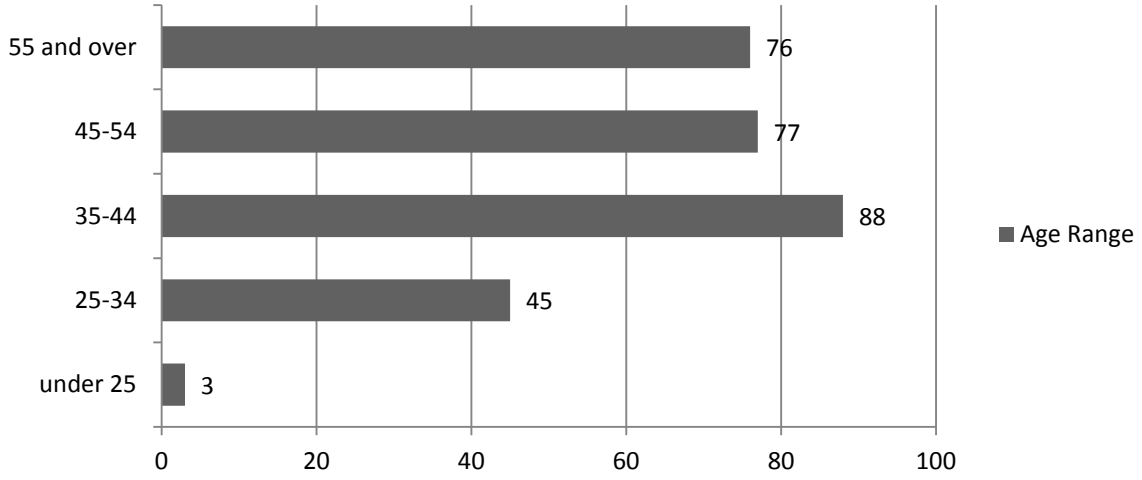



**Figure 5.21: Age distribution of respondents, N = 286**

**c) Respondents' Years of Experience:** As indicated in Figure 5.22, survey respondents' years of experience was distributed fairly among all categories. Given that more than 88% of them had more than 10 years of experience in construction industry, reflects the respondents' ability to rate soft skills of the entry level employees.

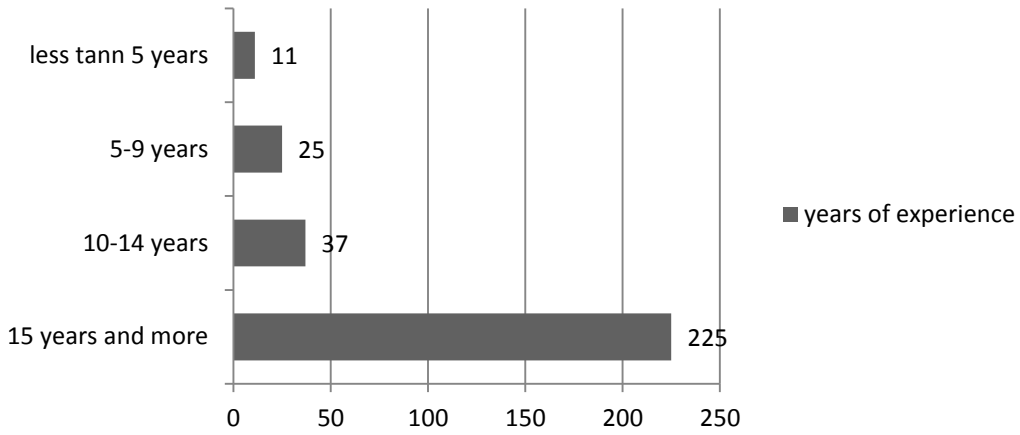



**Figure 5.22: Years of experience, N = 298**

**d) Respondents' Position:** As indicated in Figure 5.23, survey respondents represent a wide range of positions within their organizations.

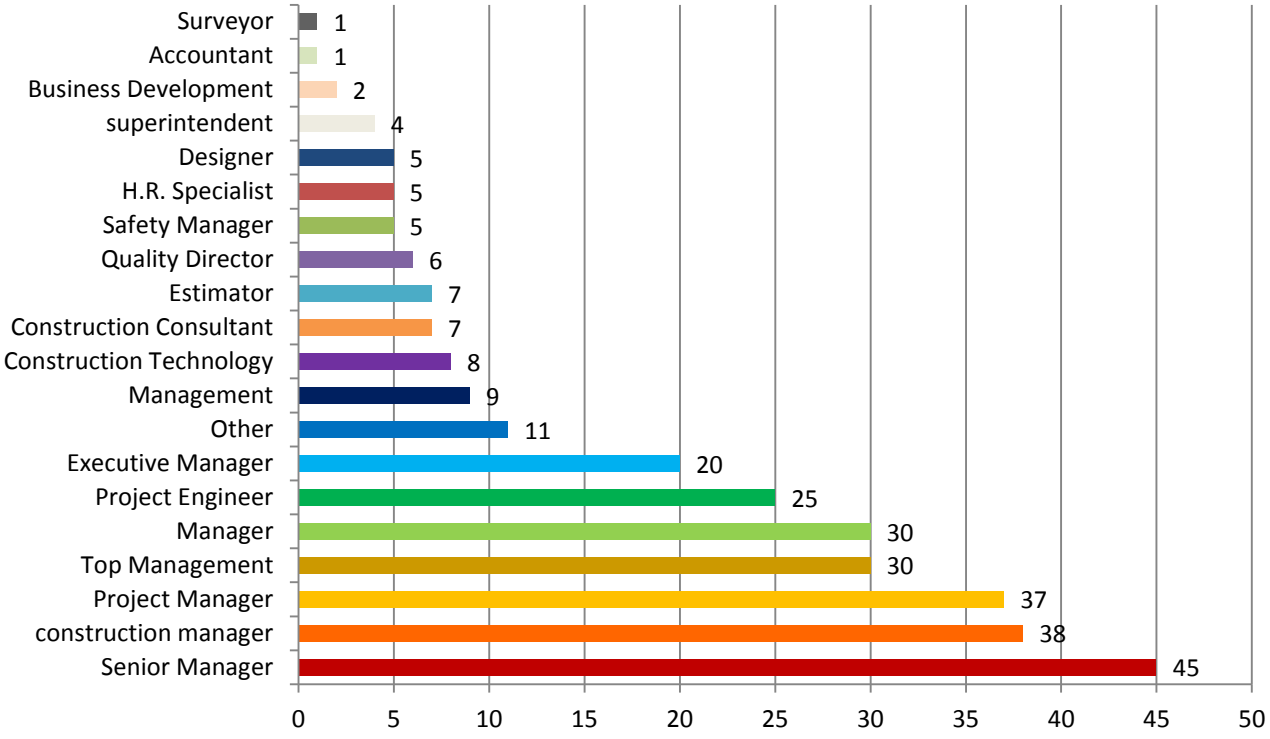



**Figure 5.23: The respondents' positions, N = 297, Top Management:** (*CEO, President, Vic-president, and Owner*).

**e) A/E/C Type of Organization:** As indicated in Figure 5.24, a range of A/E/C organizations were represented in the sample. However, **a** majority of the participants were employed primarily in general contractor firms and construction management firms**.**

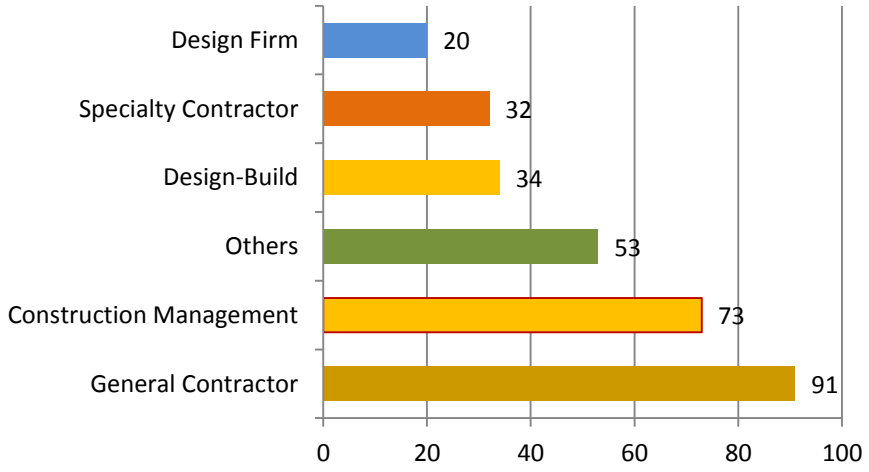



**Figure 5.24: A/E/C Type of organization, N = 303**

f) **Size of Organization:** As indicated in Figure 5.25, a broad range of organization sizes was represented in the sample. However, more than 65% of the survey participants were employed primarily in a large size firm with over 100 employees.

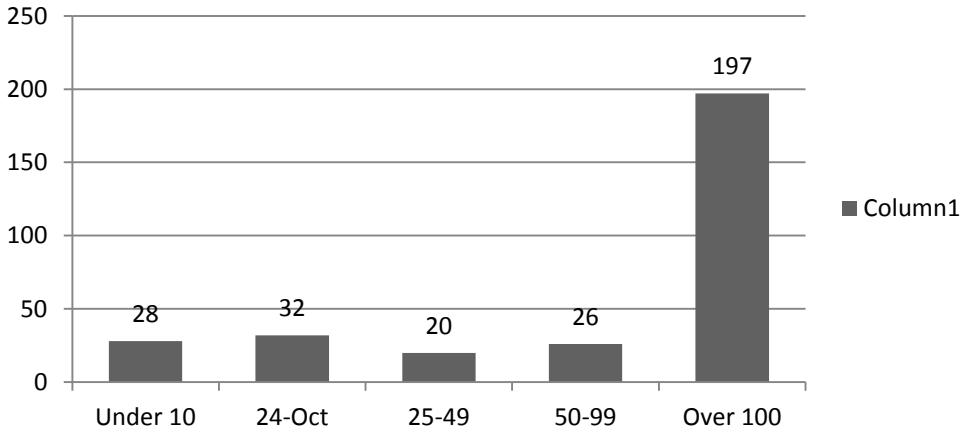



**Figure 5.25: Size of organization, N = 303**

g) **The Geographic Scope:** The US's four main regions as defined by the Census Bureau were provided as well as an "Other" category. As indicated in Figure 5.26, the survey respondents were broadly distributed among the four regions. This diverse geographical mix supports the survey findings as it represents the construction professionals' opinion nationwide.

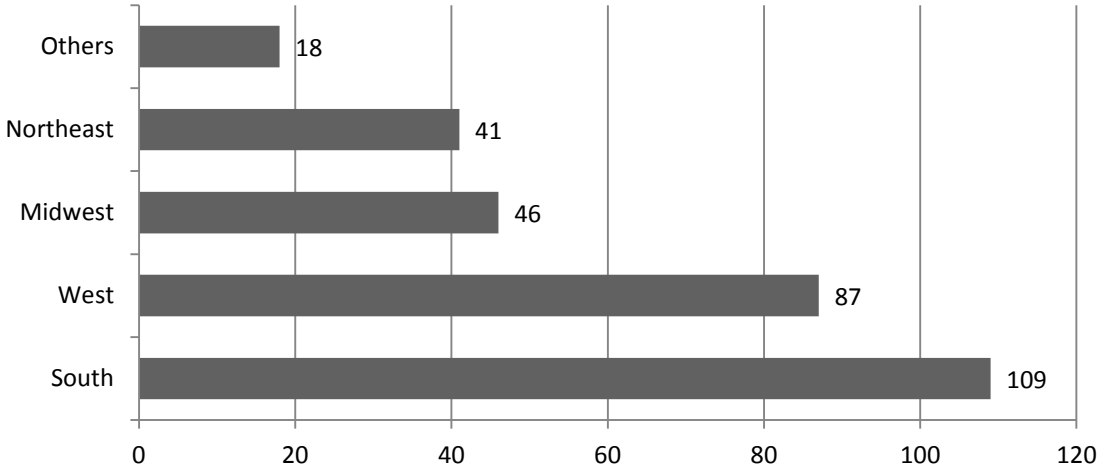



**Figure 5.26: Geographic distribution of respondents by region, N = 301,**

**Northeast:** *(New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) & Mid-Atlantic (New Jersey, New York, and Pennsylvania)),* **Midwest:** *(East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin) & West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota)),* **South:** *(South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington D.C., and West Virginia) & East South Central (Alabama, Kentucky, Mississippi, and Tennessee) & West South Central (Arkansas, Louisiana, Oklahoma, and Texas)),* **West:** *(Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) &Pacific (Alaska, California, Hawaii, Oregon, and Washington)).*

**Summary Responses to Q14:** As depicted in Figure 5.27, a total number of 260 respondents answered this question; 246 respondents answered with a 'Yes', and 14 respondents answered with a 'No'. This indicated that 94.6% of the respondents accepted the proposed 12 soft skills clusters taxonomy.

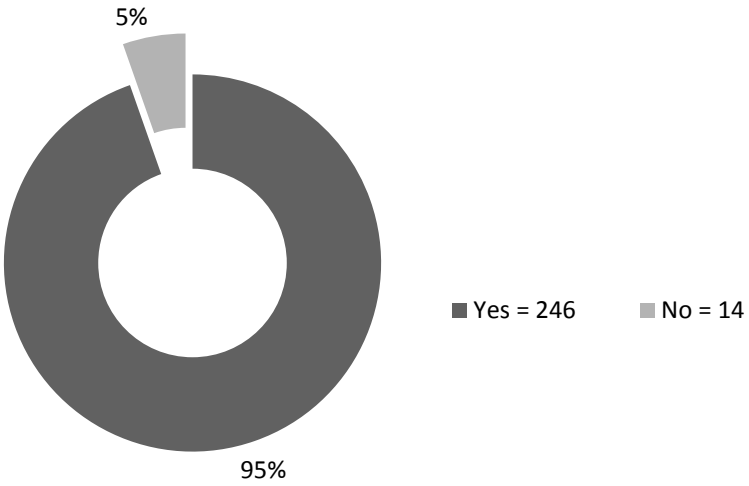



**Figure 5.27: The validation Question Results, N = 260**

In addition, the 14 respondents who answered with a 'No' offered feedback regarding reorganizing the 12 soft skills clusters, but did not suggest a new grouping of the cluster(s). Instead, they suggested to add stand-alone soft skills or highlighted the importance of some of them. Also, some of the respondents suggested adding technical skills and the graduate experience to the taxonomy. Others argued that the clusters' definitions were unclear to them. One of the 14 respondents indicated that he couldn't decide whether to accept or not accept the breakdown of the 12 clusters. Another claimed that they didn't see the need for all of the 12 clusters in their workplace.

Based one input and feedback received from question 14, the soft skills taxonomy sustained as it was proposed. Table 5.2 summarizes feedback received from the respondents to Q14 and the researcher response to their comments.

**Table 5.2 : The opinions of the 14 respondents who did not accepts the clusters and the researcher response, R: respondent**

| Code | Add/define additional Cluster(s) | Researcher response |
|---|---|---|
| R1 | • *"In this specific survey there were items I would have scored higher if they were separated more specifically. For example, (Not to say I am remembering each item in every cluster), they may be very loyal but have no conflict resolution abilities at their current level or they may not understand how stressful this filed is or can be, until they jump in with both feet and I am not sure if there is any "real" way to prepare them until they experience it first hand on a daily basis personally and at that point after accepting the realities of this industry - this is where the boys who cannot handle the stress and demands of the job are separated from men who find "healthy" ways to handle stressful situations by taking a difficult situation and doing their best to turn them into team building opportunities. This of course doesn't always happen, sometimes adults can be just as immature as children when they are upset and not getting their way, in which case you need to remind the "children" who the "parent" is and what their responsibilities are by job title, not because of an ego or false superiority issues."*<br>• *"I wish I had time to help re-define the clusters as I see them. I believe this is a VERY good start however there are still items (only a few) that should be separate from existing clusters - just my opinion, good luck."* | • No clear opinion<br>• The skills existed in the taxonomy within three different clusters<br>• The research has strong classification evidence<br>**(Dismissed)** |
| R2 | • *"Being patient and recognizing the worth of every person on the team."* | • No clear opinion<br>• The skills existed in the taxonomy<br>**(Dismissed)** |
| R3 | • *"Construction skills and problem solving."*<br>• *"Construction site experience, ability to overcome problems, ability to interact and rally the management team - engineers and architects to quickly reach a satisfactory outcome."* | • No clear opinion<br>• The skills existed in the taxonomy<br>• Construction site experience is not a soft skills<br>**(Dismissed)** |
| R4 | • *"Typically we hire new hires for technical skills; we train future leaders the soft skills. As their careers progress from entry level positions they will start to move from hard skills to soft skills. I believe your questions were a little confusing and misleading."*<br>• *"I believe there needs to be more compare and contrast of soft and hard skills, also as a side note we're looking for certain traits like; Goal-Oriented, Competitive and, Work-Centric."* | • No clear opinion<br>• The skills existed in the taxonomy<br>• Hard skills were out of the scope of this research<br>• **"*Compare and contrast of soft and hard skills*" will be a recommendation for future research** |
| R5 | • "Ability to build relationships." | • No clear opinion<br>• The skills existed in the taxonomy<br>**(Dismissed)** |
| R6 | **NA** | • No opinion<br>**(Dismissed)** |

| | | |
|---|---|---|
| R7 | • *"I do and I don't. The clusters were well grouped, but I personally do not want someone who is excellent in all these clusters. Skills very through different industries and focuses. Above average set is preferred and should be molded through experience in the work place to an excellent or high skill platform. The more someone is built up in or during their education to think they know what they are doing the more I see them fail as they cannot grip the fact that what they thought they knew isn't relevant or required in their current or future roles. I suggest more emphasis on internships and cooperative studies/experience than defining all of these clusters in a class room."* | • No clear opinion<br>• He did not reject the 12 clusters.<br>**(Dismissed)** |
| R8 | • *"Management skills as a specific discipline as opposed to part of the overall picture. Construction management is often taught as the sum of the parts being greater than the whole. Management a specific discipline is often overlooked."*<br>• *"Organizational management, managerial decision making, management science with a tie in to construction as opposed to the other way around."* | • No clear opinion<br>• The skills existed in the taxonomy<br>**(Dismissed)** |
| R9 | • *"The "clusters" have very little to do with real construction. The college grads coming in with a Project Management degree should ask for their money back. They need to be in the field and learn what is really going on. Field experience urgently needed."*<br>• *"Common sense, not people that don't want to finish their engineering degree and get in project management, I have seen this before and they are worthless. Self-education and wiliness to learn new things should be a cluster. What is the quickest way to build a box?"* | • No clear opinion<br>• Field experience is not a soft skills<br>• The skills existed in the taxonomy<br>• The research has strong classification evidence<br>**(Dismissed)** |
| R10 | • *"Technology skills (I am currently working in a project to replace myself intentionally with the thought that we are all part of planned obsolescence; students should be thinking this way. No matter what you manage, how can you reduce FTE to one with specialist resources on call)."*<br>• *"Problem definition, Solutions development, Stakeholder buy-in, Solution development and deployment, Monitor and measure, Constant Process Improvement"* | • No clear opinion<br>• Technology skills are not a soft skills<br>• The skills existed in the taxonomy<br>**(Dismissed)** |
| R11 | • *"The content of each of the clusters is too broad. There are smaller sectors that would rank high or rank low, causing me to rank the sector as defined as average."*<br>• *"Common sense should be a sector all to itself."* | • No clear opinion<br>• The skills existed in the taxonomy<br>• The research has strong classification evidence<br>**(Dismissed)** |
| R12 | • *"Street skills for construction work, knowing the culture, work force culture, client culture, and being connected to street level intelligence is very important... This is what an immigrant lacks greatly for example ... And women have challenge catching up a bit, if raised in high class society"* | • No clear opinion<br>• The skills existed in the taxonomy<br>**(Dismissed)** |

| | | |
|---|---|---|
| R13 | • You've clustered these so broadly that all one can realistically answer is in the middle unless they're really opinionated and biased. In general while today's graduates entering the marketplace may have different technical skills than we did thirty (+/-) years ago, they're still basically the same people. We interview and cull out those who don't fit our basic parameters in that regard. The one thing that I see however in our industry is an increased emphasis, and awareness, on student's parts of social awareness and global perspectives and in general an overall heightened sense of political correctness and expectation that we're a global society. While we all certainly need to respect each other and behave properly as individuals, they seem to have an expectation that all of society is driven towards creating this new world order, or great society, which they get filled with in academia yet it has little bearing in the real world. To that extent they also learn about Lean Delivery as though there is this great philosophical think tank of individuals on every project scheduling in 4D and 5D. When they get out they are too frequently surprised to see how many subcontractors can't even prepare a simple bar chart in Excel let alone a Primavera schedule. There seems to be TOO much emphasis on the soft skills and not enough meat and potatoes so to speak.<br>• I would uncluster most and ask more finite questions. | • No clear opinion<br>**(Dismissed)** |
| R14 | • Conflict resolution and collaboration are the same thing. Define "self-Intelligence skills"? How come you have nothing on technical knowledge base? Adaptive learning skills? Problem solving? I can have a very productive member who is only good if I show them point A and point B - I need someone who I can say I need you to get to "here" now go. | • No clear opinion<br>• The skills existed in the taxonomy<br>• The research has strong classification evidence<br>• Technical skills were out of the research scope<br>**(Dismissed)** |

**The survey instrument validity and reliability:** The survey data was analyzed by a team of two members from Virginia Tech's Laboratory for Interdisciplinary Statistical Analysis (**LISA**). Principal Component Analysis and Monte Carlo Parallel Analysis were used to examine the validity of the survey. Cronbach's Alpha was subsequently used to examine the reliability of the survey. The following are the major points in LISA's report:

- Correlations among survey items indicated that there were modest to moderate levels of overlaps across these items (r = .23 to .55 for importance items; r = .19 to .60 for satisfaction items).
- The analysis suggested that the survey measured two dimensions: satisfaction (component 1) and importance (component 2). These two components were modestly correlated (r = .19).
- Correlations between the two component scores and the two questions assessing the overall satisfaction and overall importance were calculated. The satisfaction component was substantially correlated with the overall satisfaction score at r = .79, and the importance

component was substantially correlated with the overall importance score at r = .71. Cross-domain correlations were low (r = .18 and .16, respectively).

- It is important to note that such analyses in no ways suggested that the 12 theoretical clusters were practically redundant or meaningless."
- The satisfaction scale and the importance scale, suggesting great internal consistency within each dimension.

The analysis report is provided in Appendix 'C'.

### 5.3. The Structured Interview:

To address the research problem "*Current adopted solutions to bridge the soft skills gap are unstructured",* the research proposed to identify several curriculum instructional strategies and determine their effectiveness with respect to a specific set of soft skills. Thus, a list of curriculum instructional strategies was developed in the Define Phase.

The structured interviews aim to capture input from experts in academia regarding the relationships between each soft skills cluster and available curriculum instructional strategies. In relation to this research, the relationship means "*the effectiveness of using the instructional strategies to teach a specific soft skills cluster*."

**Instrument Design:** The structured interview design followed the QFD research roles and procedures. The instrument was designed using a matrix format. The top row x-axis represents the curriculum domains and alternatives. The right column y-axis represents the soft skills clusters. The respondent was asked to rank the relationship between each soft skills cluster and curriculum domain alternatives in each square.

With reference to the QFD concepts, the research proposed using the 12 soft skills clusters as industry needs which represent the "What" in the QFD. The Curriculum Domains and its alternatives represent the "How" in the QFD. The research used the education experts as respondents to the interview since they had the needed expertise to complete this matrix.

**Respondents' population:** The population for this interview comprised of experts in soft skills education.

**Sampling Technique:** The research used a non-probability convenient sample. Seven experts in soft skills education were contacted based on their expertise and willingness to participate in the interview.

**Respondents' rating scale:** With acknowledgment to the QFD concepts, a scale consisting of Strong, Medium, Weak, and No relationship was used. During the data analysis, the rating was converted so that a 7 equaled a response of Strong, a 3 equaled a response of Medium, a 1 equaled a response of Weak, and a 0 equaled a response of no relationship.

**Respondents' Characteristics:** The research focused on getting a mix of experiences among the respondents. Table 5.3 summarizes the respondents' characteristics.

Table: 5.3 The interview respondents characteristics.

| Characteristics | Interviewee # | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Experience in soft skills curriculum design and delivery | X | X | X | X | X | X | X |
| Have publications related to soft skills | X | X | X | | X | X | X |
| A faculty member in a construction school | X | | X | X | | X | X |
| Faculty member in an international university | | X | X | | | | |
| Faculty member in department of education | | X | | | X | | |
| More than 5 years of experience in academia | | X | X | X | X | X | X |
| Less than 5 years of experience in academia | X | | | | | | |
| Authors of one of the 32 publications that were used to develop the soft skills taxonomy | | X | X | | | X | |

**Interview Procedure:** A list of 10 possible respondents was developed. The possible respondents were contacted using two recruitment strategies. The first one by asking them verbally (face to face) to participate and if they accepted, a face to face interview was conducted after signing a consent form. The interviewee was provided a summary of the research and the Matrix form. The interviewee then completed the form and returned it to the researcher. The second strategy was conducted by sending a recruitment email to the possible respondent. If he accepted, a consent form, the Matrix form, and a summary of the needed information were attached to a second email.

Seven experts accepted to participate and complete the Matrix form. Data received from all seven respondents was transformed to electronic format and the needed analysis was conducted.

**The structured Interview Results:**

The seven respondents' data was aggregated (**Appendix D**) and converted into electronic format. All lettered scores (acronyms) for the relationship between each soft skills cluster and each curriculum domain instructional strategies were converted to the numbered scale. Microsoft Excel was used to calculate the respondent's average score. Table 5.4 summarizes the results:

**Table 5.4 The structured interview respondents' average rating for the relationship between each soft skills cluster and each curriculum domain instructional strategies.**

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 |
| Method of course delivery: | Online class | 1.29 | 2.14 | 1.57 | 1.43 | 1.71 | 1.86 | 2.00 | 1.57 | 1.29 | 3.00 | 1.86 | 1.14 |
| | Face-to-face class ( could be hybrid | 4.43 | 3.00 | 2.86 | 2.57 | 1.57 | 2.86 | 4.00 | 2.86 | 1.71 | 2.43 | 1.86 | 2.43 |
| | Integrated in curriculum | 6.43 | 7.00 | 3.14 | 5.29 | 3.71 | 4.00 | 3.00 | 4.86 | 5.43 | 5.29 | 4.86 | 5.43 |
| | Learning contract | 2.14 | 2.43 | 2.14 | 2.43 | 1.29 | 2.43 | 1.43 | 3.14 | 1.86 | 1.86 | 1.57 | 1.29 |
| | Accelerated class | 3.43 | 3.14 | 1.71 | 3.00 | 3.43 | 2.57 | 2.57 | 1.14 | 0.57 | 1.43 | 1.14 | 0.86 |
| The pedagogical approach: | Traditional education | 2.00 | 2.71 | 2.00 | 2.00 | 1.57 | 3.57 | 1.71 | 2.57 | 1.71 | 3.86 | 1.43 | 2.14 |
| | Roll playing/simulation-based learning | 4.57 | 5.86 | 4.29 | 5.29 | 3.71 | 4.71 | 4.29 | 4.29 | 4.71 | 2.43 | 5.00 | 5.29 |
| | Problem/project based learning | 4.43 | 4.43 | 6.43 | 6.43 | 2.14 | 5.57 | 5.29 | 4.00 | 1.86 | 4.14 | 4.43 | 3.86 |
| | Reflection learning | 5.57 | 6.43 | 3.43 | 4.00 | 3.00 | 5.00 | 4.00 | 4.00 | 5.00 | 3.00 | 5.00 | 4.86 |
| | Game-based learning. | 2.14 | 3.29 | 3.29 | 3.86 | 1.57 | 2.29 | 2.43 | 3.00 | 0.86 | 2.29 | 2.14 | 1.71 |
| Course assessment: | Presentations | 7.00 | 4.57 | 2.29 | 3.29 | 4.86 | 4.29 | 2.29 | 2.29 | 2.43 | 2.86 | 4.00 | 4.43 |
| | Portfolios reports | 3.57 | 2.43 | 1.29 | 0.86 | 1.71 | 2.43 | 1.86 | 1.00 | 0.86 | 3.43 | 3.14 | 2.00 |
| | Self-assessment and peer-assessment | 6.43 | 4.86 | 3.86 | 4.86 | 2.86 | 3.00 | 2.57 | 1.86 | 4.00 | 1.86 | 4.86 | 4.57 |
| | Online tools | 2.71 | 1.71 | 0.57 | 2.29 | 0.71 | 1.71 | 1.71 | 1.14 | 0.71 | 2.00 | 1.43 | 1.43 |
| | Assignments, reports and projects | 4.00 | 3.14 | 0.86 | 2.14 | 2.86 | 2.14 | 1.29 | 1.86 | 1.43 | 3.14 | 3.14 | 2.71 |
| Course feedback: | Course blog | 3.57 | 1.43 | 0.71 | 1.86 | 0.71 | 2.00 | 1.43 | 2.14 | 2.43 | 1.00 | 3.00 | 2.86 |
| | Formal university student feedback process | 1.14 | 0.57 | 0.86 | 0.43 | 1.29 | 1.14 | 1.71 | 2.57 | 0.86 | 0.43 | 2.57 | 2.29 |
| | End of course discussion | 3.43 | 2.43 | 2.86 | 2.43 | 1.57 | 2.71 | 0.71 | 2.00 | 1.29 | 1.43 | 2.14 | 3.29 |
| | Course wiki and. | 3.00 | 1.57 | 1.86 | 1.86 | 0.71 | 1.43 | 0.86 | 1.57 | 2.43 | 1.14 | 1.86 | 1.43 |
| | Course forum | 4.43 | 4.71 | 3.00 | 2.71 | 2.00 | 2.71 | 1.00 | 1.71 | 2.71 | 1.57 | 3.86 | 4.29 |
| Student academic level: | Freshman level | 2.43 | 2.43 | 1.57 | 2.43 | 1.57 | 1.57 | 1.57 | 2.43 | 2.43 | 2.43 | 1.57 | 2.14 |
| | Sophomore level | 2.43 | 2.43 | 1.57 | 3.00 | 1.57 | 1.57 | 1.57 | 2.43 | 2.43 | 3.00 | 1.86 | 2.43 |
| | Junior level | 2.43 | 3.00 | 1.86 | 3.00 | 2.14 | 1.57 | 1.57 | 3.00 | 3.00 | 3.00 | 1.86 | 3.00 |
| | Senior level | 3.00 | 3.00 | 3.00 | 3.00 | 2.43 | 2.43 | 2.43 | 3.00 | 3.00 | 3.00 | 2.43 | 3.00 |
| | Mixed level: two levels or more | 2.43 | 1.86 | 2.43 | 2.43 | 1.86 | 1.86 | 1.86 | 2.43 | 2.43 | 2.43 | 1.86 | 2.43 |
| Learning resources: | Handouts material | 3.43 | 2.57 | 2.43 | 1.71 | 2.29 | 2.86 | 2.71 | 2.71 | 2.43 | 3.14 | 2.86 | 2.71 |
| | Text book(s), | 1.29 | 0.71 | 1.57 | 1.86 | 1.43 | 1.57 | 1.57 | 2.14 | 0.71 | 2.14 | 1.00 | 0.86 |
| | Manual book(s), | 1.29 | 1.00 | 0.57 | 1.00 | 0.71 | 1.00 | 0.86 | 2.14 | 0.57 | 1.57 | 1.00 | 0.86 |
| | Case studies | 2.29 | 2.43 | 2.29 | 2.29 | 0.57 | 3.29 | 2.43 | 3.14 | 2.00 | 1.86 | 1.29 | 1.86 |
| | Learning management system | 2.43 | 2.14 | 1.71 | 2.14 | 2.00 | 3.29 | 2.00 | 3.57 | 1.71 | 1.29 | 2.14 | 1.57 |
| Classroom size and layout: | Over-sized class (>25) | 0.71 | 0.71 | 1.57 | 0.71 | 1.57 | 1.00 | 0.57 | 1.00 | 0.57 | 1.00 | 1.00 | 1.14 |
| | Regular class (20 -25) | 2.86 | 1.86 | 2.14 | 1.86 | 1.86 | 1.86 | 1.43 | 1.86 | 2.29 | 1.86 | 2.71 | 2.29 |
| | Small class (<20) | 4.43 | 3.86 | 3.29 | 3.86 | 2.71 | 3.29 | 2.00 | 3.86 | 2.00 | 3.86 | 3.86 | 3.43 |
| | One cluster setting | 1.43 | 1.14 | 1.14 | 1.14 | 1.00 | 2.43 | 1.43 | 2.43 | 1.14 | 1.00 | 2.29 | 2.71 |
| | Small clusters setting | 4.43 | 3.43 | 3.57 | 4.43 | 2.86 | 3.86 | 1.71 | 3.29 | 2.29 | 2.86 | 2.43 | 3.86 |
| Instructor(s) background: | Competent instructor from academia | 3.29 | 2.71 | 1.86 | 2.43 | 1.86 | 3.29 | 2.71 | 2.43 | 2.29 | 2.29 | 2.43 | 2.29 |
| | Group of instructors from academia | 4.43 | 3.86 | 2.29 | 3.43 | 1.00 | 3.29 | 2.14 | 2.43 | 2.29 | 2.29 | 1.86 | 2.29 |
| | Speakers from industry | 3.57 | 4.00 | 1.71 | 1.71 | 0.29 | 3.57 | 2.43 | 1.57 | 1.43 | 1.43 | 1.29 | 0.86 |
| | Trainers from industry | 1.71 | 1.86 | 1.29 | 1.86 | 1.00 | 2.43 | 2.14 | 1.57 | 1.14 | 2.29 | 1.57 | 1.14 |
| | Instructor from academia with industry experience | 2.29 | 3.29 | 2.29 | 2.43 | 1.43 | 3.86 | 3.71 | 3.00 | 2.86 | 1.43 | 1.57 | 1.43 |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

### 5.4. Summary:

This chapter focused on measuring the existing state of soft skills among construction graduates and the relationship between the soft skills clusters and the curriculum instructional strategies (Each cluster with 40 instructional strategies). The input was acquired from construction industry and construction academia. The accumulative information from the Define Phase and the Measure Phase will be used in the following phases to achieve the research objectives.

# CHAPTER 6: THE ANALYZE PHASE

## 6.1 Introduction:

This chapter discusses in detail the third phase of the proposed theoretical framework: the Analyze Phase. The objectives of the Analyze Phase are:

- Calculate the gap score for the 12 soft skills clusters.
- Prioritize the 12 soft skills clusters.
- Calculate the relative weight for each curriculum instructional strategy.

To achieve these objectives, three sequential analysis methods were conducted. Those are:

#1: A Gap Score Analysis.

#2: A Quadrant Analysis.

#3: A Quality Function Deployment (QFD) Analysis.

The gap score analysis revealed a gap in all 12 clusters. The quadrant analysis prioritized and grouped the 12 clusters into 4 sets. The QFD analysis calculated the relative weight for the 40 instructional strategies applied to each set.

The highlighted area in Figure 6.1 illustrates the scope of this chapter within the proposed theoretical framework.

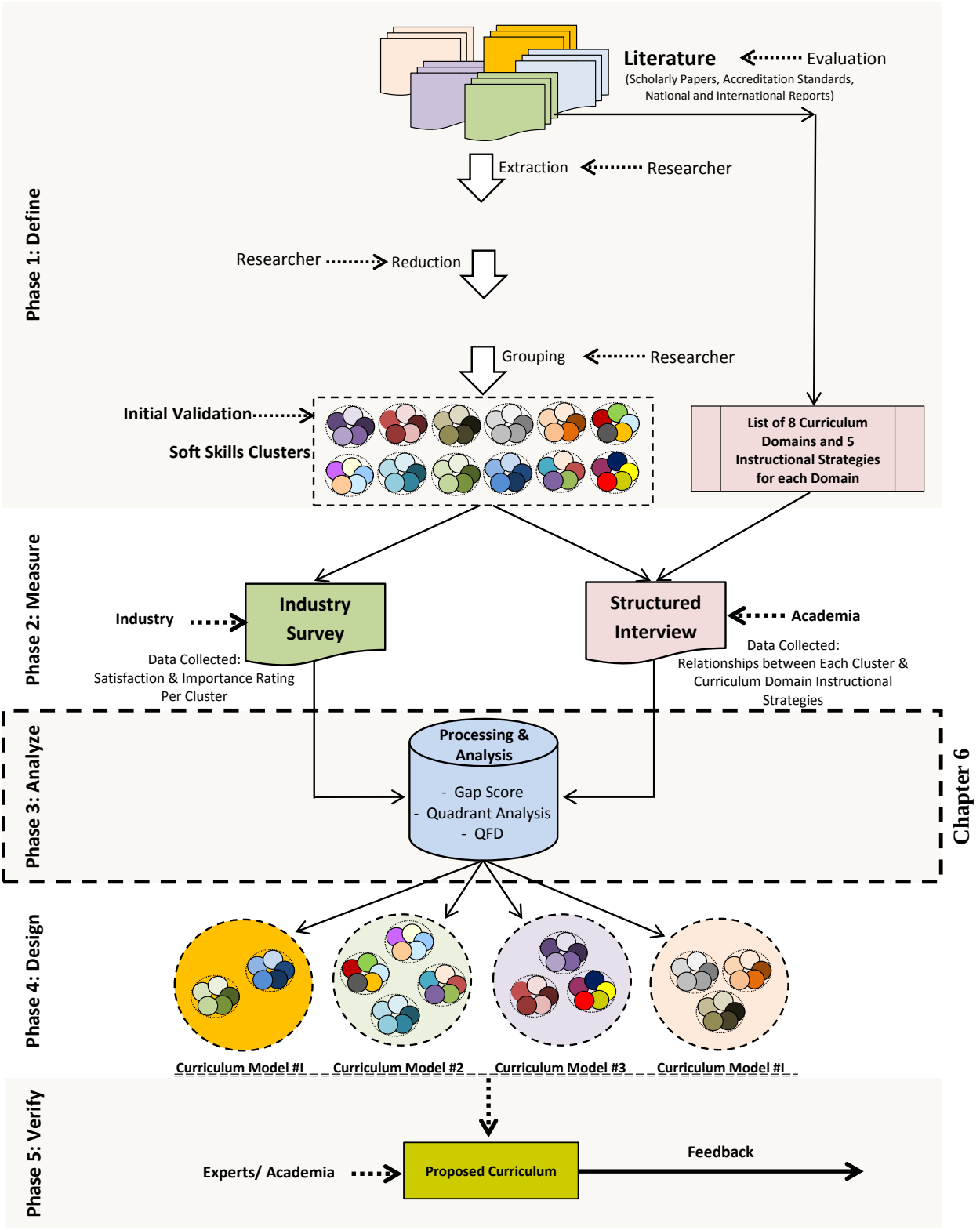



**Figure 6.1: The scope of chapter 6 within the proposed theoretical framework**

The following is a detailed description of the three analysis methods that were conducted:

### 6.2 The Gap score Analysis:

The gap analysis method aims to calculate the gap score for the 12 soft skills clusters (The actual performance for the soft skills among graduates). The gap score analysis is proposed by the SERVQUAL Model (Zeithaml et al. 1990). This analysis acknowledged the work of some scholars such as Gonzalez and Lim (Gonzalez et al. 2008; Gonzalez et al. 2011; Lim et al. 2013) who used a comparison of the importance (the expectation) and satisfaction (the performance) to measure the gap (the service quality) as per the equation:

- **Gap Score (G) = Importance Mean Score (I) - Satisfaction Mean Score (S)**

The needed data for the gap score was collected from the industry survey. For each soft skills cluster, the survey measured the value of the importance and satisfaction on a scale from 1 to 5. The gap score for each cluster was calculated using the previous equation (G=I-S). Table 6.1 summarizes the gap score calculation for the 12 soft skills clusters based on the industry survey.

Table 6.1: The gap score calculations, n = 306, C: Cluster, AV: Average Value, OA: Overall

| Code | Cluster | Importance Mean | Satisfaction Mean | Gap Score |
|---|---|---|---|---|
| C1 | Communication skills | 4.48 | 3.23 | 1.25 |
| C2 | Workplace thinking skills | 4.45 | 3.34 | 1.11 |
| C3 | Conflict resolution and negotiation skills | 4.14 | 2.87 | 1.27 |
| C4 | Teamwork and collaboration skills | 4.15 | 3.30 | 0.85 |
| C5 | Stress-management skills | 4.08 | 3.06 | 1.02 |
| C6 | Workplace professionalism skills | 4.12 | 3.22 | 0.90 |
| C7 | Workplace productivity skills | 4.03 | 3.25 | 0.78 |
| C8 | Workplace ethics skills | 4.40 | 3.44 | 0.96 |
| C9 | Workplace diversity skills | 3.62 | 3.38 | 0.24 |
| C10 | Planning and organizing skills | 4.25 | 3.26 | 0.99 |
| C11 | Self-intelligence skills | 3.98 | 3.29 | 0.69 |
| C12 | Social intelligence skills | 3.95 | 3.12 | 0.83 |
| **AV** | **Average Value for all 12 clusters** | **4.14** | **3.23** | **0.91** |
| **OA** | **Overall 12 clusters** | **4.18** | **3.21** | **0.97** |

The results show that there is a gap in all twelve clusters. The gap score values ranged between **0.24** and **1.27**. The largest gap exists in "*Cluster #3: Conflict resolution and negotiation skills*". The smallest gap exists in "*Cluster #9: Workplace diversity"*. The graph in Figure 6.2 is a plot of the gap score for each of the 12 clusters and the overall soft skills. The Average Value (AV) for all 12 clusters and the gap score for the Overall 12 clusters (OA) (Question #13 in the survey) are also plotted.

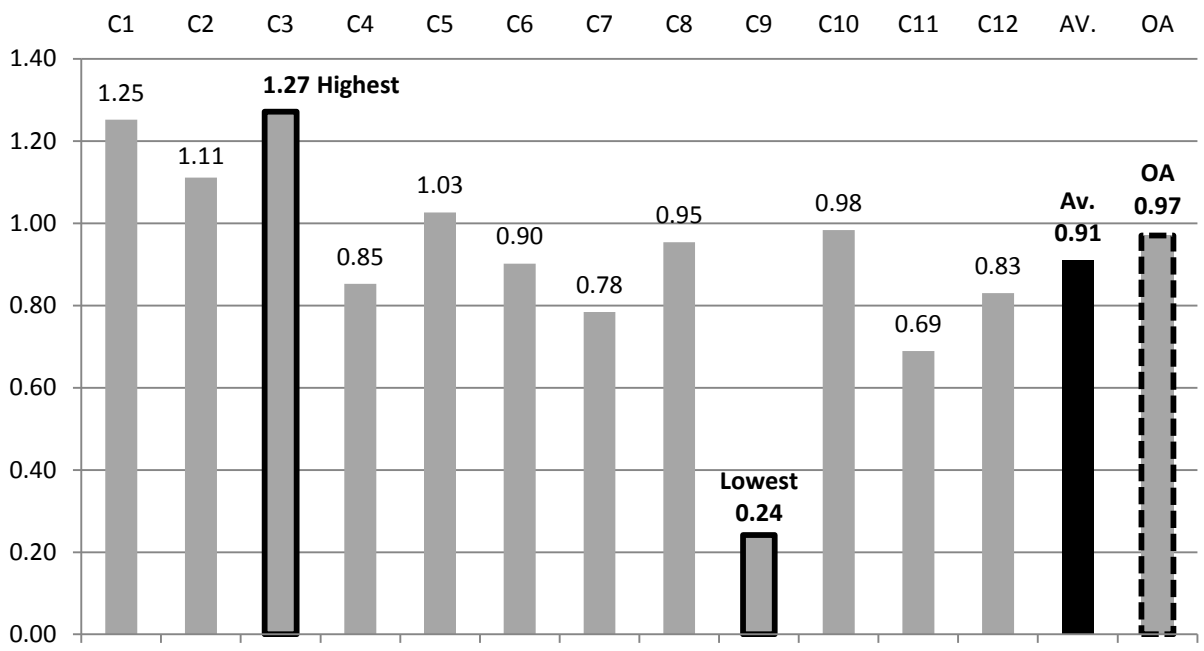



**Figure 6.2: The gap score for the 12 clusters,** (C1: Cluster #1: Communication skills, C2: Cluster #2: Workplace thinking skills, C3: Cluster #3: Conflict resolution and negotiation skills, C4: Cluster #4: Teamwork and collaboration skills, C5: Cluster #5: Stress-management skills, C6: Cluster #6: Workplace professionalism skills, C7: Cluster #7: Workplace productivity skills, C8: Cluster #8: Workplace ethics skills, C9: Cluster #9: Workplace diversity skills, C10: Cluster #10: Planning and organizing skills, C11: Cluster #11: Self intelligence skills, C12: Cluster #12: Social intelligence skills)

The gaps identified in all 12 clusters are an indication that the respondents' level of importance is higher than their satisfaction for all clusters. Therefore, an action is required. In other words, the level of performance among the construction graduates in entry level positions across the 12 clusters is less than what is expected by the industry. These results support the problem statement.

Based on the Gap Score analysis, the twelve clusters are ranked as follows:

1. Cluster #3: Conflict resolution and negotiation skills
2. Cluster #1: Communication skills
3. Cluster #2:Workplace thinking skills
4. Cluster #5: Stress-management skills
5. Cluster #10: Planning and organizing skills
6. Cluster #8: Workplace ethics skills
7. Cluster #6: Workplace professionalism skills
8. Cluster #4: Teamwork and collaboration skills
9. Cluster #7: Workplace productivity skills
10. Cluster #12: Social intelligence skills
11. Cluster #11: Self-intelligence skills
12. Cluster #9: Workplace diversity skills

### 6.3 The Quadrant Analysis:

The quadrant analysis was used to group the 12 soft skills clusters further into four sets. The rationale behind this is to offer a better allocation of resources and organizational attempts to eliminate or reduce the gap in each cluster.

For each cluster, the mean value of importance and the mean value of satisfaction were calculated and plotted as (X, Y) points. The X axis represents the Relative Satisfaction and the Y axis represents the Relative Importance.

The average value of the Relative Satisfaction scores (**X**ave.) was calculated. Similarly, the average value of the Relative Importance score (**Y**ave.) was calculated. The two average values (**X**ave.,**Y**ave.) were plotted. Vertical and horizontal lines were drawn passing through the average points as shown in Figure 6.3.

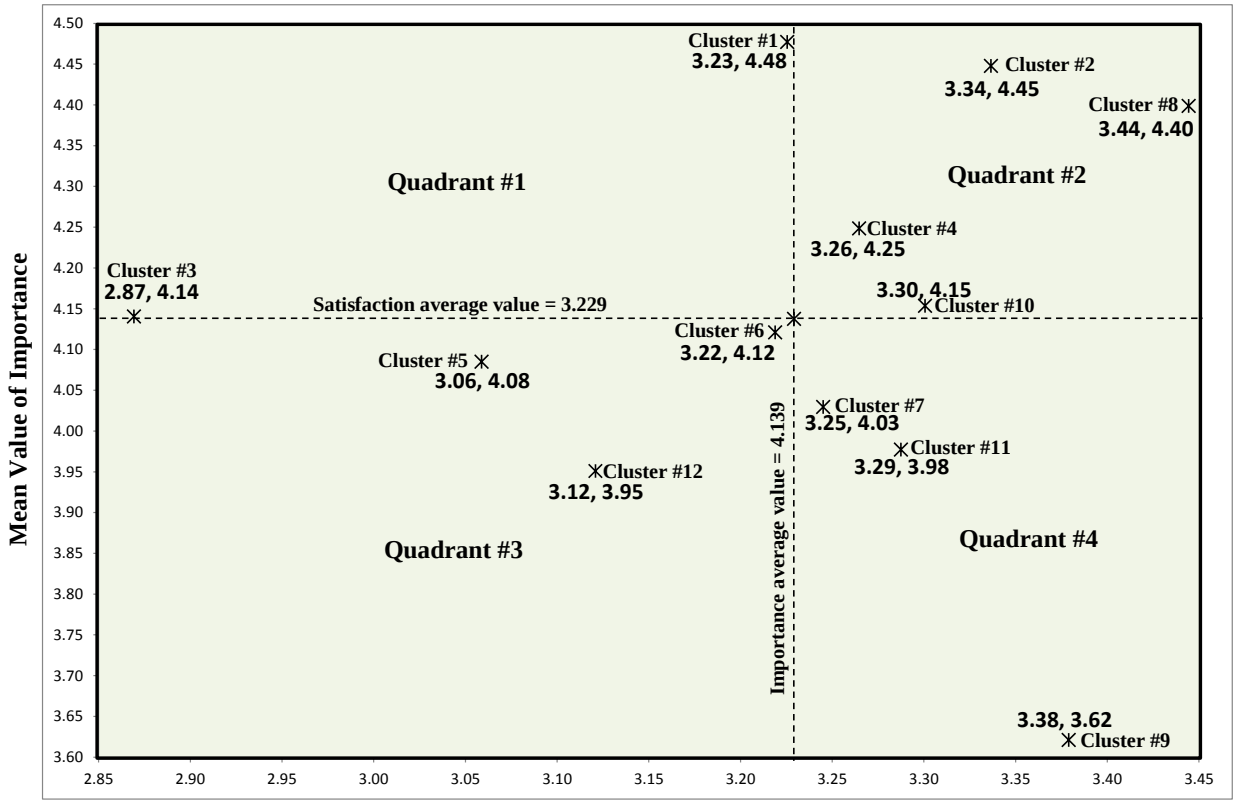



**Figure 6.3: The soft skills' clusters satisfaction/ important distribution** (*Cluster #1: Communication skills, Cluster #2: Workplace thinking skills, Cluster #3: Conflict resolution and negotiation skills, Cluster #4: Teamwork and collaboration skills, Cluster #5: Stress-management skills, Cluster #6: Workplace professionalism skills, Cluster #7: Workplace productivity skills, Cluster #8: Workplace ethics skills, Cluster #9: Workplace diversity skills, Cluster #10: Planning and organizing skills, Cluster #11: Self intelligence skills, Cluster #12: Social intelligence skills*)

This resulted in four quadrants. The following inferences are made:

- Clusters that fall above the Relative Importance average value (**Y**ave.) are considered as clusters with a high importance value (Quadrant #1 & #2).
- Clusters that fall below the Relative Importance average value (**Y**ave.) are considered as clusters with a low importance value (Quadrant #3 & #4).
- Clusters that fall to the right of the Relative Satisfaction average value (**X**ave.) are considered as clusters with a high satisfaction value (Quadrant #2 & #4).
- Clusters that fall to the lift of the Relative Satisfaction average value (**X**ave.) are considered as clusters with a low satisfaction value (Quadrant #1 & #3).

Figure (6.4) illustrates the distribution of the 12 clusters across the four quadrants based on results from Figure 6.3.

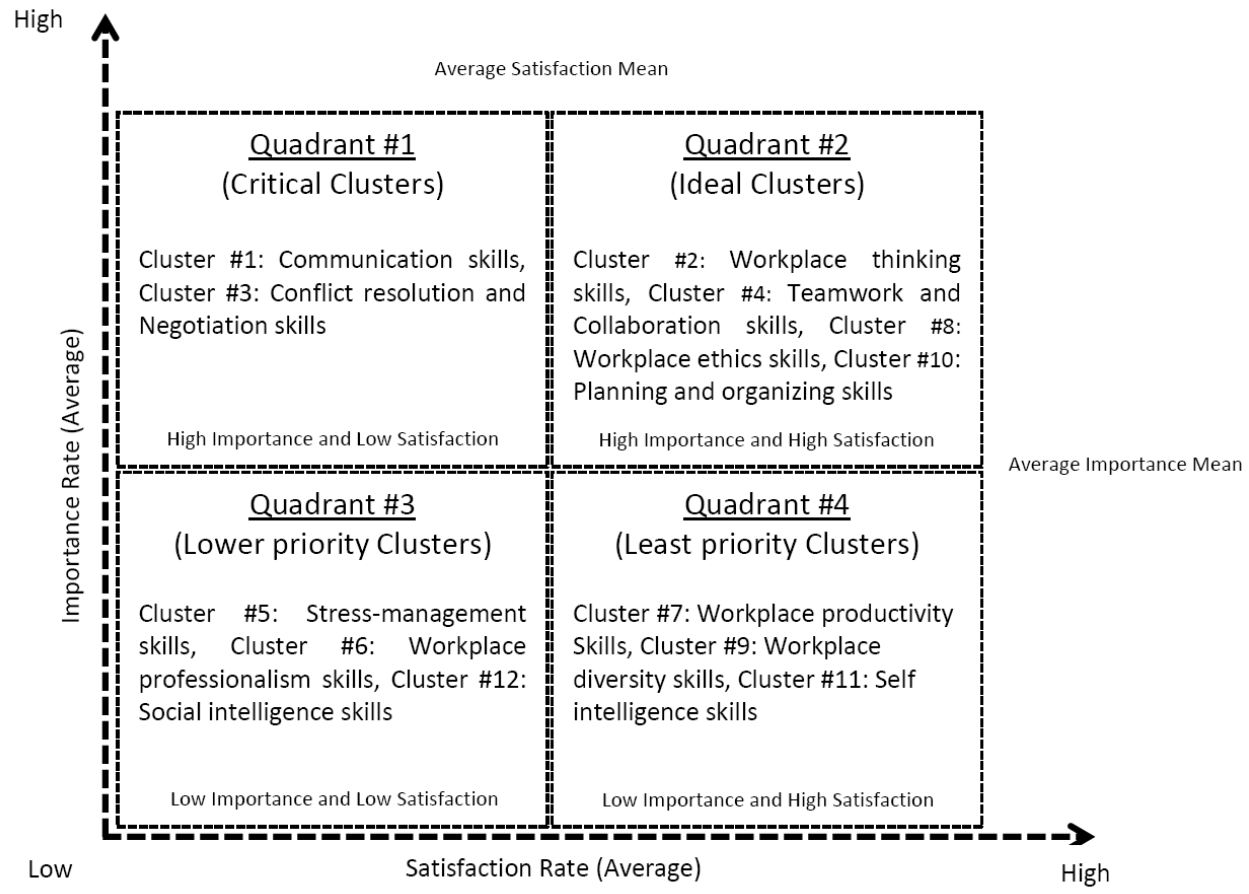
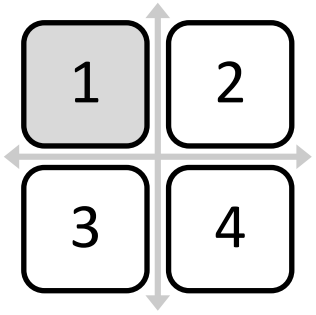



**Figure 6.4: The (12) clusters distribution between the (4) quadrants**

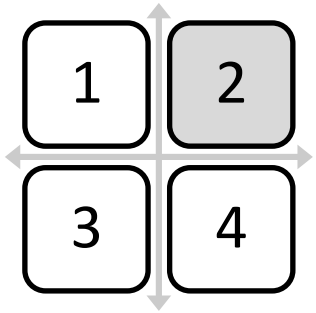
The four quadrants are classified as follows:

1. Quadrant #1: This is the “Critical Clusters” quadrant and encompasses soft skills clusters with the highest importance and lowest satisfaction scores. These clusters represent the most critical clusters and should have the top priority to be addressed in the construction curriculum. The results show that there are two clusters in this category:



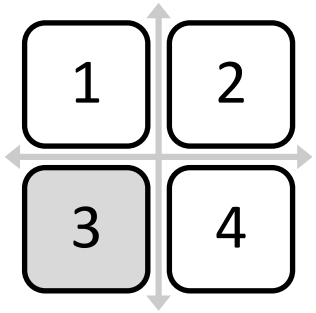

    - Cluster #1: Communication skills
    - Cluster #3: Conflict resolution and negotiation skills

2. Quadrant #2: This is the “Ideal Clusters” quadrant and encompasses soft skills clusters with the highest importance and highest satisfaction scores. These clusters are next in priority to be addressed in the construction curriculum. The results show that there are four clusters in this category:



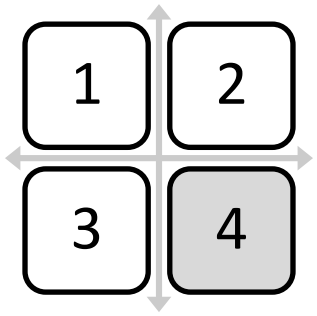

    - Cluster #2: Workplace thinking skills
    - Cluster #4: Teamwork and collaboration skills
    - Cluster #8: Workplace ethics skills
    - Cluster #10: Planning and organizing skills

3. Quadrant #3: This is the “Lower Priority Clusters” quadrant and encompasses soft skills clusters with the lowest importance and lowest satisfaction scores. These clusters are third in priority to be addressed in the construction curriculum. The results show that there are three clusters in this category:




    - Cluster #5: Stress-management skills
    - Cluster #6: Workplace professionalism skills
    - Cluster #12: Social intelligence skills

4. Quadrant #4: This is the "Least Priority Clusters" quadrant and encompasses soft skills with the lowest importance and highest satisfaction scores. These clusters have the least priority to be addressed in the construction curriculum. The results show that there are three clusters in this category:




    - Cluster #7: Workplace productivity skills
    - Cluster #9: Workplace diversity skills
    - Cluster #11: Self intelligence skills

## 6.4 The Quality Function Deployment (QFD) Analysis:

As discussed earlier, QFD is a structured planning tool used to fulfill the customers' expectations. In this study, QFD is used to define the effective instructional strategies that best fulfill the construction industry's need for soft skills among construction graduates so that it can be translated into actionable strategies. The QFD tool is used to define industry soft skills needs and translate these needs into a soft skills curriculum by analyzing the relationship between the construction industry's needs (The soft skills taxonomy) and the curriculum instructional strategies. The new curriculum will allow for increasing the soft skills cultivation among construction students to meet the industry's needs after graduation.

The research constructed four QFD matrices. Each QFD matrix targets the soft skills clusters existing in each of the four quadrants of Figure 6.4. The four QFD matrices utilized data from the following sources as shown in Figure 6.5:

- The soft skills taxonomy
- The curriculum instructional strategies list
- The industry survey
- The structured interview
- The quadrant analysis
- The relative weight values for each strategy is calculated by multiplying the soft skills cluster's importance mean value with the relationship value for each cluster in the set, then adding all these values row wise.

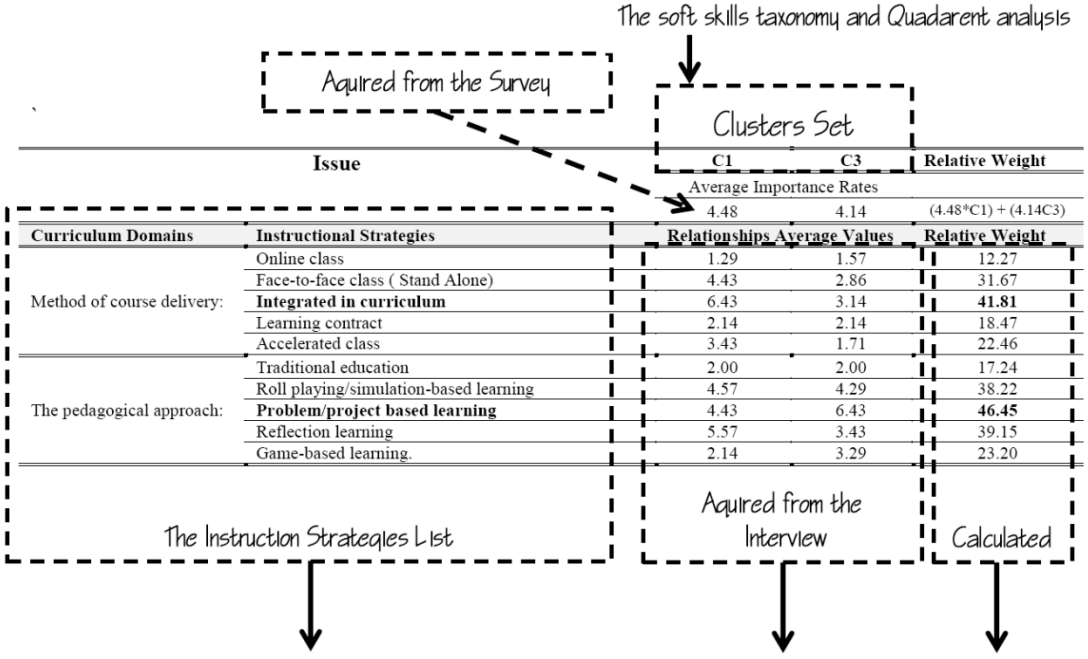



**Figure 6.5: An example to illustrate the source of data for each QFD matrix**

Table 6.2, 6.3, 6.4 and 6.5 summarize the four QFD matrixes.

**Matrix 1**: This matrix represents the relationship between the first priority clusters set (Critical Clusters) and the curriculum instructional strategies. It also calculates the relative weight for each strategy.

**Table 6.2 QFD #1**

| Issue | | C1 | C3 | Relative Weight |
|---|---|---|---|---|
| | | Average Importance Rates | | |
| | | 4.48 | 4.14 | (4.48*C1) + (4.14C3) |
| **Curriculum Domains** | **Instructional Strategies** | **Relationships Average Values** | | **Relative Weight** |
| Method of course delivery: | Online class | 1.29 | 1.57 | 12.27 |
| | Face-to-face class ( Stand Alone) | 4.43 | 2.86 | 31.67 |
| | **Integrated in curriculum** | 6.43 | 3.14 | **41.81** |
| | Learning contract | 2.14 | 2.14 | 18.47 |
| | Accelerated class | 3.43 | 1.71 | 22.46 |
| The pedagogical approach: | Traditional education | 2.00 | 2.00 | 17.24 |
| | Roll playing/simulation-based learning | 4.57 | 4.29 | 38.22 |
| | **Problem/project based learning** | 4.43 | 6.43 | **46.45** |
| | Reflection learning | 5.57 | 3.43 | 39.15 |
| | Game-based learning | 2.14 | 3.29 | 23.20 |
| Course assessment: | Presentations | 7.00 | 2.29 | 40.82 |
| | Portfolios reports | 3.57 | 1.29 | 21.32 |
| | **Self-assessment and peer-assessment** | 6.43 | 3.86 | **44.77** |
| | Online tools | 2.71 | 0.57 | 14.53 |
| | Assignments, reports and projects | 4.00 | 0.86 | 21.47 |
| Course feedback: | Course blog | 3.57 | 0.71 | 18.96 |
| | Formal University student feedback process | 1.14 | 0.86 | 8.67 |
| | End of course discussion | 3.43 | 2.86 | 27.19 |
| | Course wiki | 3.00 | 1.86 | 21.13 |
| | **Course forum** | 4.43 | 3.00 | **32.26** |
| Student academic level: | Freshman level | 2.43 | 1.57 | 17.39 |
| | Sophomore level | 2.43 | 1.57 | 17.39 |
| | Junior level | 2.43 | 1.86 | 18.57 |
| | **Senior level** | 3.00 | 3.00 | **25.86** |
| | Mixed level: two levels or more | 2.43 | 2.43 | 20.93 |
| Learning resources: | **Handouts material** | 3.43 | 2.43 | **25.41** |
| | Text book(s) | 1.29 | 1.57 | 12.27 |
| | Manual book(s) | 1.29 | 0.57 | 8.13 |
| | Case studies | 2.29 | 2.29 | 19.70 |
| | Learning management system | 2.43 | 1.71 | 17.98 |
| Classroom size and layout: | Over-sized class (>25) | 0.71 | 1.57 | 9.71 |
| | Regular class (20 -25) | 2.86 | 2.14 | 21.67 |
| | **Small class (<20)** | 4.43 | 3.29 | **33.44** |
| | One cluster setting | 1.43 | 1.14 | 11.13 |
| | **Small clusters setting** | 4.43 | 3.57 | **34.63** |
| Instructor(s) background: | Competent instructor from academia | 3.29 | 1.86 | 22.41 |
| | **Group of instructors from academia** | 4.43 | 2.29 | **29.30** |
| | Speakers from industry | 3.57 | 1.71 | 23.10 |
| | Trainers from industry | 1.71 | 1.29 | 13.00 |
| | Instructor from academia with industry experience | 2.29 | 2.29 | 19.70 |

**(C1: Cluster #1: Communication skills, C2: Cluster #2: Workplace thinking skills, C3: Cluster #3: Conflict resolution and negotiation skills, C4: Cluster #4: Teamwork and collaboration skills, C5: Cluster #5: Stress-management skills, C6: Cluster #6: Workplace professionalism skills, C7: Cluster #7: Workplace productivity skills, C8: Cluster #8: Workplace ethics skills, C9: Cluster #9: Workplace diversity skills, C10: Cluster #10: Planning and organizing skills, C11: Cluster #11: Self intelligence skills, C12: Cluster #12: Social intelligence skills)**

Note: The relative weight values for each strategy is found by multiplying the soft skills cluster importance mean value with the relationship value for each cluster in the set, then adding all these values row wise.

**Matrix 2**: This matrix represents the relationship between the second priority clusters set (Ideal Clusters) and the curriculum instructional strategies. It also calculates the relative weight for each strategy.

**Table 6.3: QFD #2**

| Issue | | C2 | C4 | C8 | C10 | Relative Weight |
|---|---|---|---|---|---|---|
| | | Average Importance Rates | | | | |
| | | 4.45 | 4.15 | 4.4 | 4.25 | =(4.45*C2)+(4.15*C4)+(4.4*C8)+(4.25*C10) |
| **Curriculum Domains** | **Instructional Strategies** | Relationships Average Values | | | | **Relative Weight** |
| Method of course delivery: | Online class | 2.14 | 1.43 | 1.57 | 3.00 | 35.13 |
| | Face-to-face class ( Stand Alone) | 3.00 | 2.57 | 2.86 | 2.43 | 46.91 |
| | **Integrated in curriculum** | 7.00 | 5.29 | 4.86 | 5.29 | **96.92** |
| | Learning contract | 2.43 | 2.43 | 3.14 | 1.86 | 42.61 |
| | Accelerated class | 3.14 | 3.00 | 1.14 | 1.43 | 37.54 |
| The pedagogical approach: | Traditional education | 2.71 | 2.00 | 2.57 | 3.86 | 48.09 |
| | Roll playing/simulation-based learning | 5.86 | 5.29 | 4.29 | 2.43 | 77.18 |
| | **Problem/project based learning** | 4.43 | 6.43 | 4.00 | 4.14 | **81.59** |
| | Reflection learning | 6.43 | 4.00 | 4.00 | 3.00 | 75.56 |
| | Game-based learning | 3.29 | 3.86 | 3.00 | 2.29 | 53.54 |
| Course assessment: | **Presentations** | 4.57 | 3.29 | 2.29 | 2.86 | **56.18** |
| | Portfolios reports | 2.43 | 0.86 | 1.00 | 3.43 | 33.34 |
| | **Self-assessment and peer-assessment** | 4.86 | 4.86 | 1.86 | 1.86 | **57.84** |
| | Online tools | 1.71 | 2.29 | 1.14 | 2.00 | 30.64 |
| | Assignments, reports and projects | 3.14 | 2.14 | 1.86 | 3.14 | 44.41 |
| Course feedback: | Course blog | 1.43 | 1.86 | 2.14 | 1.00 | 27.74 |
| | Formal University student feedback process | 0.57 | 0.43 | 2.57 | 0.43 | 17.46 |
| | End of course discussion | 2.43 | 2.43 | 2.00 | 1.43 | 35.76 |
| | Course wiki | 1.57 | 1.86 | 1.57 | 1.14 | 26.47 |
| | **Course forum** | 4.71 | 2.71 | 1.71 | 1.57 | **46.46** |
| Student academic level: | Freshman level | 2.43 | 2.43 | 2.43 | 2.43 | 41.89 |
| | Sophomore level | 2.43 | 3.00 | 2.43 | 3.00 | 46.69 |
| | **Junior level** | 3.00 | 3.00 | 3.00 | 3.00 | **51.75** |
| | **Senior level** | 3.00 | 3.00 | 3.00 | 3.00 | **51.75** |
| | Mixed level: two levels or more | 1.86 | 2.43 | 2.43 | 2.43 | 39.35 |
| Learning resources: | **Handouts material** | 2.57 | 1.71 | 2.71 | 3.14 | **43.86** |
| | Text book(s) | 0.71 | 1.86 | 2.14 | 2.14 | 29.42 |
| | Manual book(s) | 1.00 | 1.00 | 2.14 | 1.57 | 24.71 |
| | **Case studies** | 2.43 | 2.29 | 3.14 | 1.86 | **42.01** |
| | Learning management system | 2.14 | 2.14 | 3.57 | 1.29 | 39.61 |
| Classroom size and layout: | Over-sized class (>25) | 0.71 | 0.71 | 1.00 | 1.00 | 14.79 |
| | Regular class (20 -25) | 1.86 | 1.86 | 1.86 | 1.86 | 32.04 |
| | **Small class (<20)** | 3.86 | 3.86 | 3.86 | 3.86 | **66.54** |
| | One cluster setting | 1.14 | 1.14 | 2.43 | 1.00 | 24.76 |
| | **Small clusters setting** | 3.43 | 4.43 | 3.29 | 2.86 | **60.24** |
| Instructor(s) background: | Competent instructor from academia | 2.71 | 2.43 | 2.43 | 2.29 | 42.56 |
| | **Group of instructors from academia** | 3.86 | 3.43 | 2.43 | 2.29 | **51.79** |
| | Speakers from industry | 4.00 | 1.71 | 1.57 | 1.43 | 37.90 |
| | Trainers from industry | 1.86 | 1.86 | 1.57 | 2.29 | 32.60 |
| | Instructor from academia with industry experience | 3.29 | 2.43 | 3.00 | 1.43 | 43.97 |

**(C1: Cluster #1: Communication skills, C2: Cluster #2: Workplace thinking skills, C3: Cluster #3: Conflict resolution and negotiation skills, C4: Cluster #4: Teamwork and collaboration skills, C5: Cluster #5: Stress-management skills, C6: Cluster #6: Workplace professionalism skills, C7: Cluster #7: Workplace productivity skills, C8: Cluster #8: Workplace ethics skills, C9: Cluster #9: Workplace diversity skills, C10: Cluster #10: Planning and organizing skills, C11: Cluster #11: Self intelligence skills, C12: Cluster #12: Social intelligence skills).**

Note: The relative weight values for each strategy is found by multiplying the soft skills cluster importance mean value with the relationship value for each cluster in the set, then adding all these values row wise.

**Matrix 3**: This matrix represents the relationship between the third priority clusters (Lower Priority Clusters) and the curriculum instructional strategies. It also calculates the relative weight for each strategy.

Table 6.4 QFD #3

| Issue | | C5 | C6 | 12 | Relative Weight |
|---|---|---|---|---|---|
| | | Average Importance Rates | | | |
| | | 4.09 | 4.12 | 3.95 | =(4.09*C5)+(4.12*C6)+(3.95*C12) |
| **Curriculum Domains** | **Instructional Strategies** | Relationships Average Values | | | **Relative Weight** |
| Method of course delivery: | Online class | 1.71 | 1.86 | 1.14 | 19.18 |
| | Face-to-face class ( Stand Alone) | 1.57 | 2.86 | 2.43 | 27.79 |
| | **Integrated in curriculum** | 3.71 | 4.00 | 5.43 | **53.11** |
| | Learning contract | 1.29 | 2.43 | 1.29 | 20.34 |
| | Accelerated class | 3.43 | 2.57 | 0.86 | 28.00 |
| The pedagogical approach: | Traditional education | 1.57 | 3.57 | 2.14 | 29.61 |
| | **Roll playing/simulation-based learning** | 3.71 | 4.71 | 5.29 | **55.49** |
| | Problem/project based learning | 2.14 | 5.57 | 3.86 | 46.95 |
| | Reflection learning | 3.00 | 5.00 | 4.86 | 52.06 |
| | Game-based learning | 1.57 | 2.29 | 1.71 | 22.62 |
| Course assessment: | **Presentations** | 4.86 | 4.29 | 4.43 | **55.02** |
| | Portfolios reports | 1.71 | 2.43 | 2.00 | 24.92 |
| | Self-assessment and peer-assessment | 2.86 | 3.00 | 4.57 | 42.10 |
| | Online tools | 0.71 | 1.71 | 1.43 | 15.63 |
| | Assignments, reports and projects | 2.86 | 2.14 | 2.71 | 31.24 |
| Course feedback: | Course blog | 0.71 | 2.00 | 2.86 | 22.45 |
| | Formal University student feedback process | 1.29 | 1.14 | 2.29 | 19.00 |
| | End of course discussion | 1.57 | 2.71 | 3.29 | 30.59 |
| | Course wiki | 0.71 | 1.43 | 1.43 | 14.45 |
| | **Course forum** | 2.00 | 2.71 | 4.29 | **36.29** |
| Student academic level: | Freshman level | 1.57 | 1.57 | 2.14 | 21.37 |
| | Sophomore level | 1.57 | 1.57 | 2.43 | 22.49 |
| | Junior level | 2.14 | 1.57 | 3.00 | 27.09 |
| | **Senior level** | 2.43 | 2.43 | 3.00 | **31.79** |
| | Mixed level: two levels or more | 1.86 | 1.86 | 2.43 | 24.84 |
| Learning resources: | **Handouts material** | 2.29 | 2.86 | 2.71 | **31.84** |
| | Text book(s) | 1.43 | 1.57 | 0.86 | 15.70 |
| | Manual book(s) | 0.71 | 1.00 | 0.86 | 10.43 |
| | Case studies | 0.57 | 3.29 | 1.86 | 23.21 |
| | Learning management system | 2.00 | 3.29 | 1.57 | 27.92 |
| Classroom size and layout: | Over-sized class (>25) | 1.57 | 1.00 | 1.14 | 15.06 |
| | Regular class (20 -25) | 1.86 | 1.86 | 2.29 | 24.28 |
| | **Small class (<20)** | 2.71 | 3.29 | 3.43 | **38.18** |
| | One cluster setting | 1.00 | 2.43 | 2.71 | 24.82 |
| | **Small clusters setting** | 2.86 | 3.86 | 3.86 | **42.81** |
| Instructor(s) background: | **Competent instructor from academia** | 1.86 | 3.29 | 2.29 | **30.16** |
| | Group of instructors from academia | 1.00 | 3.29 | 2.29 | 26.66 |
| | Speakers from industry | 0.29 | 3.57 | 0.86 | 19.27 |
| | Trainers from industry | 1.00 | 2.43 | 1.14 | 18.61 |
| | Instructor from academia with industry experience | 1.43 | 3.86 | 1.43 | 27.38 |

**(C1: Cluster #1: Communication skills, C2: Cluster #2: Workplace thinking skills, C3: Cluster #3: Conflict resolution and negotiation skills, C4: Cluster #4: Teamwork and collaboration skills, C5: Cluster #5: Stress-management skills, C6: Cluster #6: Workplace professionalism skills, C7: Cluster #7: Workplace productivity skills, C8: Cluster #8: Workplace ethics skills, C9: Cluster #9: Workplace diversity skills, C10: Cluster #10: Planning and organizing skills, C11: Cluster #11: Self intelligence skills, C12: Cluster #12: Social intelligence skills)**

Note: The relative weight values for each strategy is found by multiplying the soft skills cluster importance mean value with the relationship value for each cluster in the set, then adding all these values row wise.

**Matrix 4**: This matrix represents the relationship between the fourth priority clusters set (Least Priority Clusters) and the curriculum instructional strategies. It also calculates the relative weight for each strategy.

Table 6.5 QFD #4

| Issue | | C7 | C9 | C11 | Relative Weight |
|---|---|---|---|---|---|
| | | Average Importance Rates | | | |
| | | 3.25 | 3.38 | 3.29 | =(3.25*C7)+(3.38*C9)+(3.29*C11) |
| **Curriculum Domains** | **Instructional Strategies** | **Relationships Average Values** | | | **Relative Weight** |
| Method of course delivery: | Online class | 2.00 | 1.29 | 1.86 | 20.11 |
| | Face-to-face class ( Stand Alone) | 4.00 | 1.71 | 1.86 | 29.72 |
| | **Integrated in curriculum** | 3.00 | 5.43 | 4.86 | **51.07** |
| | Learning contract | 1.43 | 1.86 | 1.57 | 18.73 |
| | Accelerated class | 2.57 | 0.57 | 1.14 | 16.98 |
| The pedagogical approach: | Traditional education | 1.71 | 1.71 | 1.43 | 18.80 |
| | **Roll playing/simulation-based learning** | 4.29 | 4.71 | 5.00 | **54.24** |
| | Problem/project based learning | 5.29 | 1.86 | 4.43 | 45.65 |
| | **Reflection learning** | 4.00 | 5.00 | 5.00 | **54.12** |
| | Game-based learning | 2.43 | 0.86 | 2.14 | 21.42 |
| Course assessment: | Presentations | 2.29 | 2.43 | 4.00 | 33.92 |
| | Portfolios reports | 1.86 | 0.86 | 3.14 | 23.10 |
| | **Self-assessment and peer-assessment** | 2.57 | 4.00 | 4.86 | **44.17** |
| | Online tools | 1.71 | 0.71 | 1.43 | 15.18 |
| | Assignments, reports and projects | 1.29 | 1.43 | 3.14 | 22.86 |
| Course feedback: | Course blog | 1.43 | 2.43 | 3.00 | 26.49 |
| | Formal University student feedback process | 1.71 | 0.86 | 2.57 | 20.25 |
| | End of course discussion | 0.71 | 1.29 | 2.14 | 16.06 |
| | Course wiki | 0.86 | 2.43 | 1.86 | 19.64 |
| | **Course forum** | 1.00 | 2.71 | 3.86 | **29.21** |
| Student academic level: | Freshman level | 1.57 | 2.43 | 1.57 | 21.38 |
| | Sophomore level | 1.57 | 2.43 | 1.86 | 22.52 |
| | Junior level | 1.57 | 3.00 | 1.86 | 24.58 |
| | **Senior level** | 2.43 | 3.00 | 2.43 | **30.31** |
| | Mixed level: two levels or more | 1.86 | 2.43 | 1.86 | 23.67 |
| Learning resources: | **Handouts material** | 2.71 | 2.43 | 2.86 | **31.10** |
| | Text book(s) | 1.57 | 0.71 | 1.00 | 12.90 |
| | Manual book(s) | 0.86 | 0.57 | 1.00 | 9.50 |
| | Case studies | 2.43 | 2.00 | 1.29 | 22.14 |
| | Learning management system | 2.00 | 1.71 | 2.14 | 22.79 |
| Classroom size and layout: | Over-sized class (>25) | 0.57 | 0.57 | 1.00 | 8.35 |
| | Regular class (20 -25) | 1.43 | 2.29 | 2.71 | 24.83 |
| | **Small class (<20)** | 2.00 | 2.00 | 3.86 | **30.65** |
| | One cluster setting | 1.43 | 1.14 | 2.29 | 18.99 |
| | **Small clusters setting** | 1.71 | 2.29 | 2.43 | **24.85** |
| Instructor(s) background: | Competent instructor from academia | 2.71 | 2.29 | 2.43 | 28.88 |
| | Group of instructors from academia | 2.14 | 2.29 | 1.86 | 24.30 |
| | Speakers from industry | 2.43 | 1.43 | 1.29 | 20.08 |
| | Trainers from industry | 2.14 | 1.14 | 1.57 | 19.03 |
| | **Instructor from academia with industry experience** | 3.71 | 2.86 | 1.57 | **31.57** |

**(C1: Cluster #1: Communication skills, C2: Cluster #2: Workplace thinking skills, C3: Cluster #3: Conflict resolution and negotiation skills, C4: Cluster #4: Teamwork and collaboration skills, C5: Cluster #5: Stress-management skills, C6: Cluster #6: Workplace professionalism skills, C7: Cluster #7: Workplace productivity skills, C8: Cluster #8: Workplace ethics skills, C9: Cluster #9: Workplace diversity skills, C10: Cluster #10: Planning and organizing skills, C11: Cluster #11: Self intelligence skills, C12: Cluster #12: Social intelligence skills).**

Note: The relative weight values for each strategy is found by multiplying the soft skills cluster importance mean value with the relationship value for each cluster in the set, then adding all these values row wise.

## 6.5 Summary:

In chapter 6, three analysis methods were presented. The Gap Score Analysis results show that there is a gap in all twelve clusters**.** The results support the major research problem "*there is evidence of a significant gap between the construction industry's needs for soft skills and the preparedness of construction graduates*. This means that all 12 clusters should be addressed in developing construction curriculum. Addressing the 12 clusters can result in adding too much content to the construction curriculum while there may not be enough time to teach it all. Thus, it was decided using the Quadrant Analysis to prioritize the 12 clusters into four sets. Using the QFD Analysis, four instructional curriculum models were developed. This can offer more equitable distribution of resources and more supportive environment of soft skills teaching and learning while addressing all the 12 clusters in the curriculum.

The major outputs of this chapter are:

a. The Gap score Values for the 12 clusters and the overall soft skills.
b. Four sets of soft skills clusters based on their priority to be addressed in the curriculum.
c. Four QFD matrices, each one had a relative weight for the instructional strategies with respect to its set of soft skills clusters.

The Gap Score values will be used in the Verify Phase as an indicator to measure the development of soft skills in future work. The four QFD matrices will be used to propose four curriculum models in the Design Phase.

# CHAPTER 7: THE DESIGN PHASE

## 7.1 Introduction:

This chapter discusses in detail the fourth phase of the proposed theoretical framework: the Design Phase. The objectives of the Design Phase are:

- Define four soft skills instructional curriculum models.
- Present the researcher's understanding of the Design Phase results.

To achieve these objectives, four curriculum models along with a detailed scenario for the implementation of the four models are proposed.

Each instructional curriculum model consists of the soft skills clusters set, the implementation priority, and the effective instructional strategies for the eight curriculum domains.

The effective instructional strategies describe the construction industry's need for soft skills and how it could be integrated effectively into the construction curriculum to increase soft skills cultivation among graduates.

Reflection on the implementation of the four models is provided from the perspective of the researcher's understanding of the results. Based on this, the four curriculum models are further modified and improved.

The highlighted area in Figure 7.1 illustrates the scope of this chapter within the proposed theoretical framework.

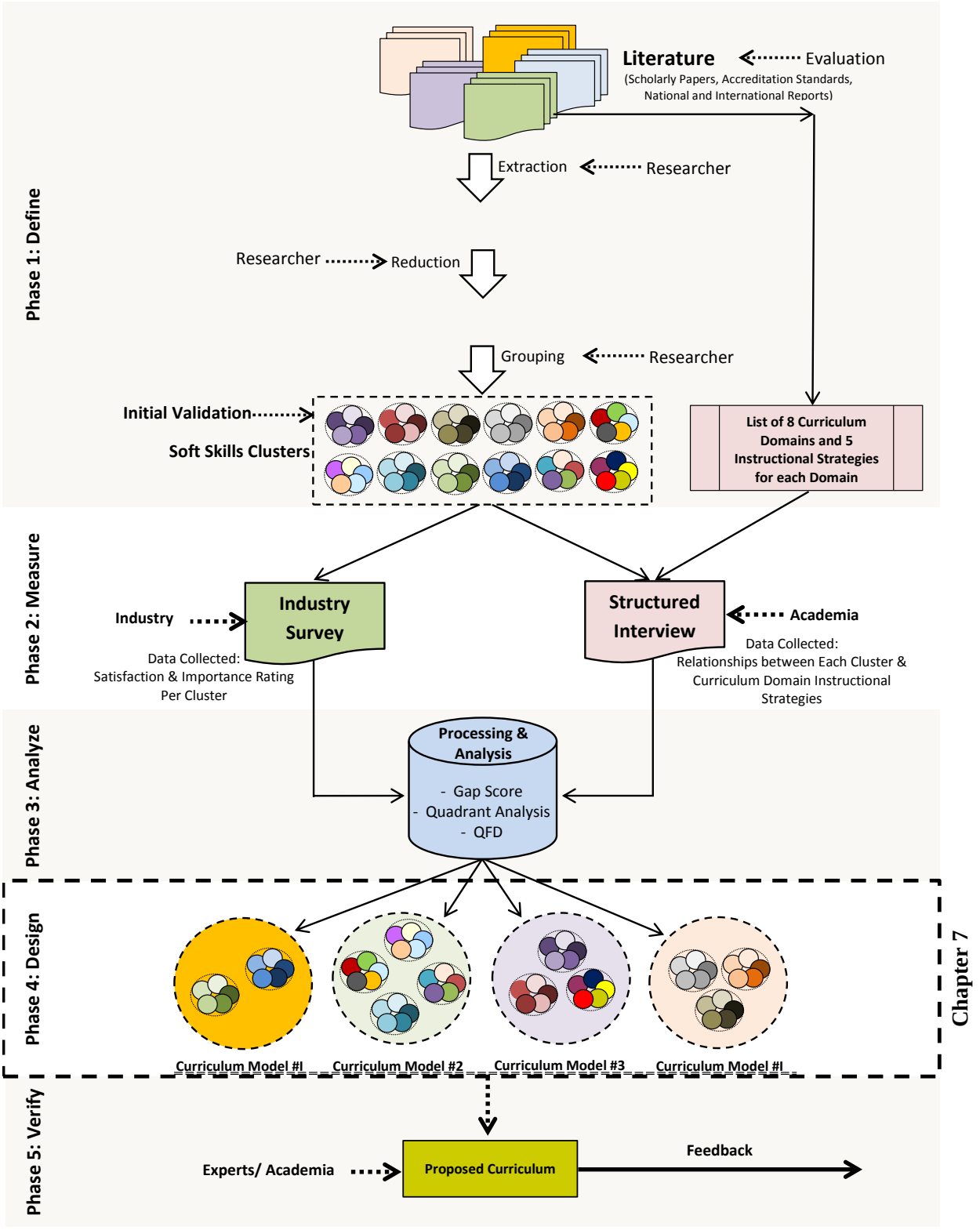



**Figure 7.1: The scope of Chapter 7 within the proposed theoretical framework**

### 7.2 Proposing the Instructional Models:

Four curriculum models were developed based on the information derived from the previous phases. The models have a hierarchical priority in their implementation. The first model has the highest priority, the second model has the second priority, and so on. Due to gaps recognized in all 12 soft skills clusters, all four models need to be implemented. Each Model defines the effective instructional strategies for the eight curriculum domains and is associated with a specific set of soft skills clusters.

For each domain in the model, the highest relative weight among the five instructional strategies was determined as the effective strategy to be used. Table 7.1 summarizes the source of information for the models:

**Table 7.1 The source of decision for each instructional curriculum Models**

| | | |
|---|---|---|
| **Model #...:** | **Knowledge Content:** | Acquired the clusters sets and the priority from the Quadrant Analysis as follows:<br>▪ Model #1 used the output of Quadrant #1<br>▪ Model #2 used the output of Quadrant #2<br>▪ Model #3 used the output of Quadrant #3<br>▪ Model #4 used the output of Quadrant #4 |
| | **Priority:** | |
| | **Method of Course Delivery:**<br>**The pedagogical approach:**<br>**Course assessment:**<br>**Course feedback:**<br>**Student academic level:**<br>**Learning resources:**<br>**Classroom size and layout:**<br>**Instructor(s) background:** | Each model uses the relative weight that was calculated for each strategy in the QFD analysis:<br>▪ Model #1 used the output of QFD #1<br>▪ Model #2 used the output of QFD #2<br>▪ Model #3 used the output of QFD #3<br>▪ Model #4 used the output of QFD #4 |

Table 7.2 summarized the four proposed curriculum models.

Table 7.2 The four curriculum Models

| | | |
|---|---|---|
| Model #1: | Knowledge Content: **(Critical Clusters)** | • Cluster #1: Communication Skills<br>• Cluster #3: Conflict resolution and negotiation skills |
| | Priority: | 1st Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Problem/project based learning |
| | Course assessment: | Self-assessment and peer-assessment |
| | Course feedback: | Course forum |
| | Student academic level: | Senior level |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class and Small clusters setting. |
| | Instructor(s) background: | Group of instructors from academia |
| Model #2: | Knowledge Content: **(Ideal Clusters)** | ▪ Cluster #2: Workplace thinking skills<br>▪ Cluster #4: Teamwork and collaboration skills<br>▪ Cluster #8: Workplace ethics skills<br>▪ Cluster #10: Planning and organizing skills |
| | Priority: | 2nd Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Problem/project based learning |
| | Course assessment: | Self-assessment and peer-assessment + Presentations |
| | Course feedback: | Course forum |
| | Student academic level: | Junior and Senior |
| | Learning resources: | Handouts material + Case studies |
| | Classroom size and layout: | Small class + Small clusters setting. |
| | Instructor(s) background: | Group of instructors from academia |
| Model #3: | Knowledge Content: **(Lower Priority Clusters)** | ▪ Cluster #5: Stress-management skills<br>▪ Cluster #6: Workplace professionalism skills<br>▪ Cluster #12: Social intelligence skills |
| | Priority: | 3rd Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Roll playing/simulation-based learning |
| | Course assessment: | Presentations |
| | Course feedback: | Course forum |
| | Student academic level: | Senior level |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class + Small clusters setting. |
| | Instructor(s) background: | Competent instructor from academia |
| Model #4: | Knowledge Content: **(Least Priority Clusters)** | ▪ Cluster #7: Workplace productivity skills<br>▪ Cluster #9: Workplace diversity skills<br>▪ Cluster #11: Self intelligence skills |
| | Priority: | 4th Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Roll playing/simulation-based learning + Reflection learning |
| | Course assessment: | Self-assessment and peer-assessment |
| | Course feedback: | Course forum |
| | Student academic level: | Any |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class + Small clusters setting. |
| | Instructor(s) background: | Instructor from academia with industry experience |

### 7.3 Researcher's Reflection on the Four Models Implementation:

Based on the four soft skills instructional curriculum models proposed, a number of practical entailments emerged. First, the four models "somehow" shared the same effective instructional strategies. Second, the course method of delivery and the pedagogical approach were the top effective domains in soft skills curriculum. Third, some of the effective strategies need to be combined with other strategies for any particular domain. Also, there is concern that these effective strategies may not work as intended given that each educator has his own personal knowledge.

The educators are blended by their personal knowledge and backgrounds. The understanding of any given curriculum is an experience issue. The research relies on the construction schools' decision makers to determine the way to conceptualize how to put the proposed effective alternatives in practice. Each educator in those schools can use his or her own understanding of those models to teach in a way that likely increases the soft skills cultivation among his students.

The researcher also believes that presenting his own interpretation for the four curriculum models may help to get everybody in construction academia onto the same path and may offer more equitable distribution of resources. Also, it may clarify how we can effectively infuse these models into an already overcrowded curriculum. The interpretation is the researcher's personal understanding to the design phase results. It focuses on proposing a stand-alone soft skills course for the first instructional model only.

**The proposed implementation plan:**

The researcher understands the soft skills curriculum as something in which, personal knowledge (for educator and learner), content (the soft skills clusters), and the process (the instructional alternatives) are in dynamic interaction. This research focuses on providing construction academia with the effective strategies to implement soft skills in construction curriculum. We can't expect individual educators to develop and infuse the four models into construction curriculum on their own. This should be organized by the university/ school's leaders or the accreditation standards.

On the other hand, it is expected that each educator's personal experience would influence the implementation. The following is a proposed implementation plan for the Design Phase.

**Method of course delivery:** The four instructional models were proposed based on the QFD analysis which showed that the education experts who were interviewed strongly supported embedding all 12 soft skills clusters in construction curriculum. From one side, this decision is logical given that the soft skills domain is still evolving and sometimes there are logistical challenges in adding a new course to the construction curriculum. Also, the educators in construction academia face various challenges in teaching such courses.

On the other hand, embedding the 12 clusters in different curriculum courses might jeopardize the good implementation of the effective instructional strategies and the soft skills clusters may get lost in the detail. Each implementation plan could significantly vary based on its objectives, the educator's experiential knowledge, and/or the priority of the expected outcomes.

The researcher supports the idea of adding four stand-alone courses to the construction curriculum to implement the proposed four models if applicable. Allocating a specific course for each model might result in adding a higher impact on the student cultivation. Sometimes this solution is not possible. As a compromise, the researcher proposes adding one stand-alone class to the construction curriculum that would accommodate the critical curriculum model #1.This might be achieved by adding a new soft skills course to the curriculum or by replacing one of the current curriculum courses with the soft skills course.

The following evidence supports this proposal:

- In a follow-up question with the interviewees who participated in the structured interview, they all clearly agreed that this proposal would be a wise choice if the construction academia decision-leaders can facilitate it.
- Some of the soft skills clusters already existed within the construction curriculum, yet the soft skills gap was evident among construction graduates.
- Many higher education institutions in the United States started adding stand-alone courses to address soft skills in different disciplines. Examples of those institutes that had a stand-alone soft skills course are: Virginia Tech University, Georgia Tech University, and Clemson University.
- The stand-alone method of course delivery ranked a strong 2$^{nd}$ within the QFD analysis.

- The industry survey statistical analysis revealed the existence of knowledge overlap among the 12 clusters. Therefore, teaching the critical soft skills clusters sets might ultimately increase the cultivation of the other soft skills. (This is to support the decision of adding one class)

For the other three instructional models, they will be left to the users (the construction schools). Each construction school might develop its own implementation plan. They can add new courses to their curriculum, align an existing course, or embed the three models into their curriculum. In this case, it is highly recommended for them to develop a matrix of clear soft skills outcomes that specify the course title and match it to the soft skills outcomes.

**The pedagogical approach:** Obviously, the problem-based pedagogical approach is an extremely effective approach to teaching soft skills. The educators should use it as a predefined pedagogical setting as a framework to develop the course content and manage its learning activities. Both pedagogies are an active learning student-centered pedagogy in which students learn about a subject through the experience of the problem/ scenario and it involves the students in doing things and thinking about the things they are doing.

For a more effective outcome, the instructor may use a hybrid pedagogical approach that focuses on problem-based learning and combined activities that uses roll playing/simulation-based learning and reflection learning. Engage students in learning knowledge through an extended inquiry process structured around complex authentic questions, and carefully designed products and tasks.

**Course assessment:** The educators may use a hybrid method of assessment that includes the educator, the presentations, reflection, and 'self-assessment and peer-assessment method'. Yet, the results suggest focusing on the 'self-assessment and peer-assessment method'. This strategy focuses on teaching the students how to measure themselves and others against some measuring stick as he learns and grows.

This means that rubric assessment criteria should be developed and it should be transparent and understandable by the students so that they can make their own decisions about their targeted soft skills performance or level. During each task, and or at the end of the task, student teams should present their work to their peers and instructors. They are assessed on their product and

their soft skills. The students also assess their team members on their collaboration skills, and write reflections on what they learned and how they can improve the work.

**Course feedback:** The educator may consider using a course electronic forum to continuously get the students' feedback on the class. This could be in the form of students' reflection or by structuring questions for the students. Also, at the end of the class, the educator should engage the students in one to one or group discussions to get the students' feedback. This way, the continuous development of the class will be guaranteed.

**Student academic level:** While literature gives less attention on how this domain contributes to better soft skills' cultivation, the research shows that delivering the critical soft skills clusters would be slightly effective if it is oriented to the students in senior level. This could be as students gain the needed knowledge base and they were more alert to understand the skills and apply them to practical problems, while the other three sets could be embedded into courses at any level.

**Learning resources:** The research shows that the educator should develop his own printed handouts for the class in addition to documenting real cases from the industry and developing the handouts and the cases to be real problems in the class.

**Classroom size and layout:** The results show that a small class (less than 20 students) coupled with using small clusters settings for the students provide an effective strategy for teaching soft skills. This could be in a form of discussion groups or teams projects. The major inference from this strategy is that construction education should start thinking on linking the space (the class room) with the pedagogy. The link could be in the class design by using small classes with multi groups' layout settings instead of using the theater style setting. Also, restrictions should be added to limit classes to less than 20 students.

**Instructor(s) background:** It is the educator who interprets and shapes the best way for soft skills adaptation in the classroom. The research shows that the effective class is when the class has more than one instructor. This strategy has a dramatic effect on student learning and engagement since it contributes to bringing multiple backgrounds to the class. Involving multiple instructors to teach soft skills classes could be done through one of the following scenarios:

> **Scenario #1:** Each faculty member can teach a small group of student and the instructors may rotate among the groups.

**Scenario #2:** Each faculty member can teach specific soft skills clusters to the students.

**Scenario #3:** The class has a coordinator and he invites the other faculty members as speakers.

The researcher recommends using the third scenario as it would be the most effective strategy. A competent instructor who has industry experience and diverse knowledge of the 12 soft skills clusters can effectively facilitate the class and invite other faculty members and industry guests to the class.

### 7.4 The proposed Soft Skills Instructional Curriculum:

Based on the previous reflection the four models were updated. The Six Sigma Level value for each soft skills cluster was calculated (please refer to Appendix E) and the Gap Score values (please refer to chapter 6, section 6.2) were posted into the soft skills curriculum. The Six Sigma Level values and the Gap Score values were benchmarks that can be used to monitor the soft skills level changes among construction graduates, and to set future development goals.

Table 7.3 summarizes the final revision of the soft skills instructional models:

Table 7.3 The Soft Skills Instructional Curriculum
Note: SL: Sigma Level, GS: Gap Score

| | | |
|---|---|---|
| **Model #1** | Knowledge Content: **(Critical Clusters)** | ▪ Cluster #1: Communication Skills, (**SL=2.08, GS=1.25**)<br>▪ Cluster #3: Conflict resolution and negotiation skills, (**SL=2.00, GS=1.27**) |
| | Priority: | 1st Priority |
| | Method of Course Delivery: | Stand-alone course |
| | The pedagogical approach: | Problem/project based learning + Roll playing/simulation-based learning |
| | Course assessment: | Presentations + Self-assessment and peer-assessment |
| | Course feedback: | Course forum + Reflection |
| | Student academic level: | Senior level |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class + Small clusters setting |
| | Instructor(s) background: | Group of instructors from academia (One coordinator) |
| **Model #2** | Knowledge Content: **(Ideal Clusters)** | ▪ Cluster #2: Workplace thinking skills, (**SL=2.18, GS=1.11**)<br>▪ Cluster #4: Teamwork and collaboration skills, (**SSL=2.32, GS=0.85**)<br>▪ Cluster #8: Workplace ethics skills, (**SL=2.28, GS=0.96**)<br>▪ Cluster #10: Planning and organizing skills, (**SL=2.23, GS=0.99**) |
| | Priority: | 2nd Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Problem/project based learning |
| | Course assessment: | Self-assessment and peer-assessment + Presentations |
| | Course feedback: | Course forum |
| | Student academic level: | Junior + Senior |
| | Learning resources: | Handouts material + Case studies |
| | Classroom size and layout: | Small class + Small clusters setting |
| | Instructor(s) background: | Group of instructors from academia |
| **Model #3** | Knowledge Content: **(Lower Priority Clusters)** | ▪ Cluster #5: Stress-management skills, (**SL=2.17, GS=1.02**)<br>▪ Cluster #6: Workplace professionalism skills, (**SL=2.28, GS=0.90**)<br>▪ Cluster #12: Social intelligence skills, (**SL=2.31, GS=0.83**) |
| | Priority: | 3rd Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Roll playing/simulation-based learning |
| | Course assessment: | Presentations |
| | Course feedback: | Course forum |
| | Student academic level: | Senior level |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class + Small clusters setting |
| | Instructor(s) background: | Competent instructor from academia |
| **Model #4** | Knowledge Content: **(Least Priority Clusters)** | ▪ Cluster #7: Workplace productivity skills, (**SL=2.36, GS=0.78**)<br>▪ Cluster #9: Workplace diversity skills, (**SL=3.00, GS=0.24**)<br>▪ Cluster #11: Self intelligence skills, (**SL=2.44, GS=0.69**) |
| | Priority: | 4th Priority |
| | Method of Course Delivery: | Integrated in curriculum |
| | The pedagogical approach: | Roll playing/simulation-based learning + Reflection learning |
| | Course assessment: | Self-assessment and peer-assessment |
| | Course feedback: | Course forum |
| | Student academic level: | All levels |
| | Learning resources: | Handouts material |
| | Classroom size and layout: | Small class + Small clusters setting |
| | Instructor(s) background: | Instructor from academia with industry experience |

Overall Soft Skills Sigma Level = **2.23**, and Overall soft skills Gape score = **0.97**

***Note: The soft Skills Taxonomy should be used to determine the sub content knowledge for the 12 clusters***

## 7.5 Summary:

This chapter offered further information to completely answer the research questions "*How do students get help to better cultivate soft skills? And how should these skills be integrated within a construction curriculum?*"

In chapter 7, four soft skills instructional models were proposed. The four models suggested embedding the soft skills within the existing construction curriculum. This may jeopardize the soft skills cultivation among the students. The researcher then presented his understanding for the four models and proposed a few changes that might guarantee the successful implementation for the soft skills in construction curriculum.

# CHAPTER 8: THE VERIFY PHASE

## 8.1 Introduction:

This chapter discusses in detail the fifth and final phase of the proposed theoretical framework: the Verify Phase. The objective of the Verify Phase is to verify the quality of the proposed soft skills instructional curriculum results.

The research results were shared with four experts in soft skills education from academia to verify the proposed soft skills instructional curriculum and to get their feedback on the quality of the results. The feedback received is documented in Appendix F and summarized in this chapter.

The highlighted area in Figure 8.1 illustrates the scope of this chapter within the proposed theoretical framework.

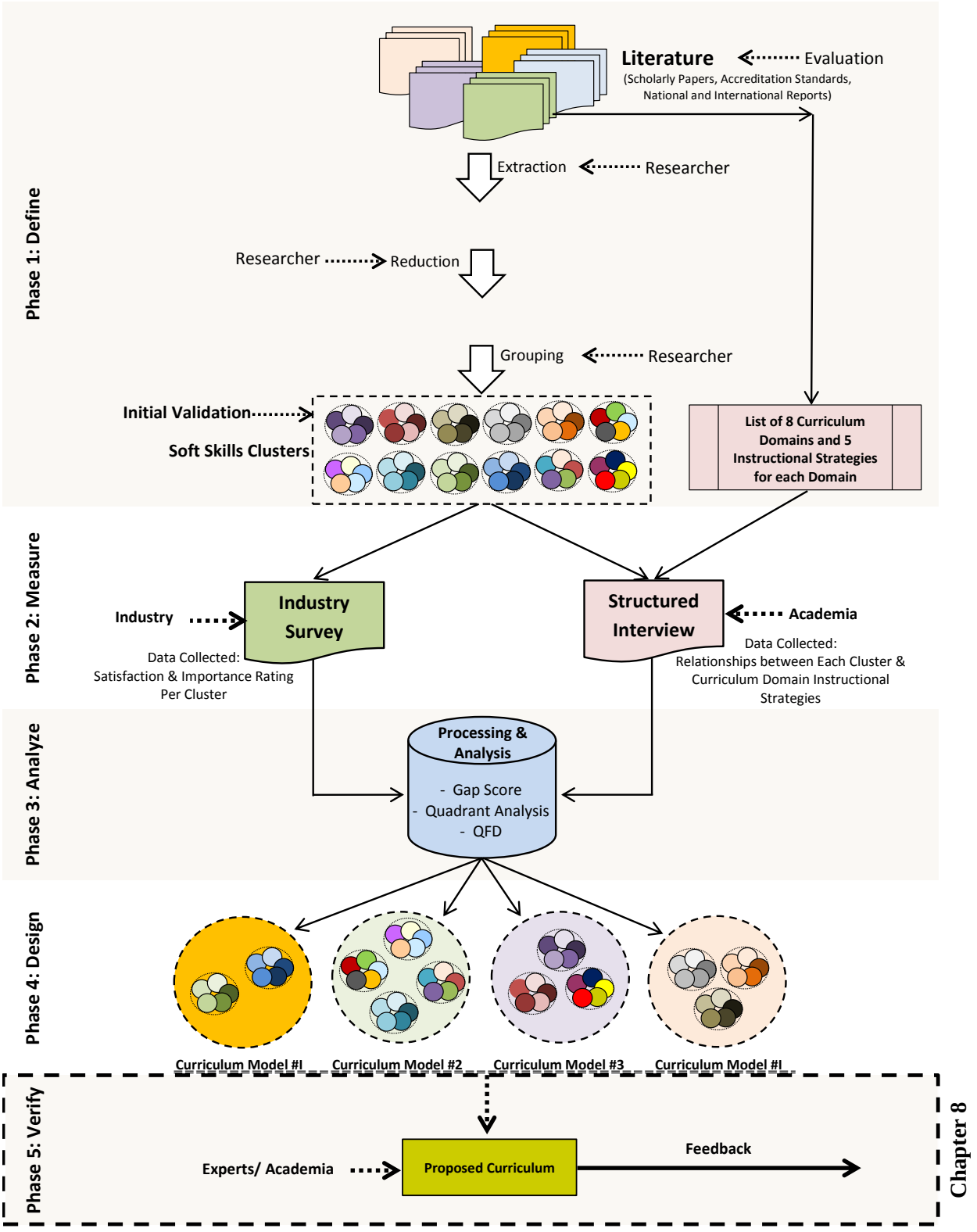



**Figure 8.1: The scope of Chapter 8 within the proposed theoretical framework**

### 8.2 Academic Experts Feedback:

The research results were shared with four experts to capture their feedback regarding the validity and visibility of the overall research results.

**Instrument Design:** The questions were used to solicit the experts' feedback. A list of six open-ended questions was developed as follows:

1. Do you think that applying the study results in construction education can help in reducing the soft skills gap?
2. Do you think that the proposed 4 Curriculum Models can help educators implement soft skills in construction education?
    a. Is it useful?
    b. Is it applicable?
    c. Is it easy to understand?
3. Comment on the quality of the theoretical framework as a design aid framework.
4. Do you think that there is any missing component from the Decision Aid framework? Or from the study?
5. What are your suggestions for improving the study?
6. What are your recommendations for future research?
7. Final thoughts?

The experts were asked to answer the questions based on a research summary document provided. The summary document included:

- The research goals.
- The research objective.
- The research methodology.
- The proposed soft skills instructional curriculum models.

**Respondents' population:** The respondents were all faculty members who are experts in soft skills education.

**Sampling Technique:** The research used a non-probability convenient sample. Four experts on soft skills education were contacted based on their expertise and willingness to participate in the interview. The experts were already familiar with the research. They were engaged in ongoing

discussion with the researcher while presenting his work in scientific conference meetings. Also, three of them participated in the instruction interviews during the Measure Phase.

**Respondents' Characteristics:** The research focused on getting a mix of experience among the respondents. Table 8.1 summarizes the respondents' characteristics.

Table: 8.1The interview respondents' characteristics

| The criteria | Expert # | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Have an experience in curriculum design/development | X | X | X | X |
| Have publications related to soft skills | X | X | | X |
| A faculty member in a construction school | X | X | X | X |
| Faculty member in an international university | | | | X |
| More than 5 years of experience in academia | | X | X | X |
| Less than 5 years of experience in academia | X | | | |
| Participated in the structured interview (The Measure Phase- Phase #2) | X | X | X | |
| Authors of one of the 32 publications that were used to develop the soft skills taxonomy | | | X | |

**Sharing Procedure:** The experts were contacted by an email invite. All of them responded and agreed to provide feedback. A second email was sent to each one of them with two attachments, containing the list of the sharing questions and the research summary document. The summary document included the research goals, research objectives, research methodology, and the proposed soft skills instructional curriculum models. After a few weeks, feedback was received. The following is a summary of the feedback received:

1. All four experts agreed that implementing the research outcomes in construction education can reduce the soft skills gap. Also, they agreed that the models were useful and applicable for construction education. One of the experts stressed that the models provided a useful framework to implement either in whole or in part, or to partially adapt to specific country/educational environments. The expert also stated "*the research outcomes can reduce the soft skills gaps for construction graduates over time as long as it is broadly applied in education. Also, the research analysis is appropriate and the results reliable. Thus, suggestions to implement the proposed instructional strategies in the curriculum are logical.*" Another expert stated that the models were not only applicable but comprehensive in terms of the types of skills and attributes that were required or were seen as optimal in Construction Management career fields.

Three experts believed that the models were very easy to understand and made sense. The forth expert disagreed and suggested adding more details to the proposed models to clearly show how it would be transferred to the education.

2. Using their own terms, all four experts commended on the quality of the proposed theoretical framework. For example, one of them stated: "*the curriculum models are an excellent design aid framework.*"

3. Given the research purpose, objectives, and questions, the experts stated that there was nothing that stood out as an important question that was not considered or overlooked in the research. They did not mention any missing component from the theoretical framework or from the research in general. However, one of the experts suggested using hybrid assessment methods combined with the self-assessment and peer assessment. Also, the expert suggested using a hybrid pedagogical approach that combines role playing/simulation-based learning with the problem based learning in all four model areas.

4. The experts didn't provide any major suggestions to improve the research. One of them suggested a little more explanation to connect the key pieces together more tightly. Also, another expert stated, "*I think that I would leave out the Quadrant Analysis or priority setting section – you could replace this with a discussion about the relative importance of different factors in different environmental, social and international settings. For example, there will be specific situations where Workplace Diversity is hugely important. To me they are all equally important. Here in Australia we would place a lot of emphasis on Workplace Ethics and Teamwork skills, but not put this above Communication, Planning and Productivity*." The research addressed this point in the research recommendation. The proposed framework targeted the soft skills gap in the United States. For the other countries, the theoretical framework can be used to develop a specific soft skills curriculum for that country based on their industry needs.

5. For future research, the experts suggested:
    - Testing the proposed soft skills instructional curriculum models in the actual classroom to determine if the soft skills cultivation increased as a result. This can be followed by comparing the construction graduates' soft skills levels between students with current education curriculum and the proposed curriculum models.

- Designing/ developing personal assessment tools to measure the outcomes of implementing the proposed models in the construction curriculum. These tools can be used to measure the freshman students' soft skills levels and then test them again following the completion of their courses and prior to graduation.
- Mapping the proposed soft skills instructional models with the applicable course titles from current construction curricula considering the budgetary issues such as limited funding, instructors, and resources.
- Collecting survey data from construction students, educators, and construction participants.

6. In the final thoughts section, the experts re-emphasized the quality of the research.
7. Finally, one of the experts suggested to map the 12 soft skills clusters with the ACCE accredited list of learning outcomes (20 learning outcomes).

   This point is addressed in Chapter 9.

**8.3 Summary:**

This chapter presented a summary feedback from experts in soft skills education regarding the validity and the visibility of the overall research results. It is concluded that the results are applicable to be implemented in construction education. Also, the feedback showed a good attitude and acceptance from the academia toward the proposed curriculum as well as the theoretical framework.

# CHAPTER 9: RESEARCH SUMMARY, CONTRIBUTION, AND FUTURE RECOMMENDATIONS

## 9.1 Research Summary:

The construction industry demands a competitive pipeline of construction graduates who possess a high level of soft skills coupled with technical skills. This research highlighted the existence of a soft skills gap among construction schools' graduates as a research problem. The gap was imputed to five problems that in combination or isolation contributed to the gap and hindered the construction graduates from possessing the expected minimum soft skills level.

The five problems include:

1. The existing content, definition, interpretations, and approaches for soft skills used among construction educators and employers are not clear.
2. Both the construction industry and academia are not aware of the nature and magnitude of the soft skills gap.
3. Current solutions to bridge the soft skills gap are unstructured.
4. The existing construction education curriculum cannot sufficiently support students to cultivate soft skills competencies to match the industry's needs. There is a lag between the construction curriculum updates as it compares to the continuous changes in the industry needs.
5. Soft skills are regarded as less important than technical skills by construction higher education accreditation bodies.

The research hypothesized that developing new learning innovations to increase the soft skills level among construction graduates would be the key solution to reduce the soft skills gap. The research proposed the innovation in the form of an effective soft skills instruction curriculum. This proposed innovation may help in overcoming the negative effect of the five problems and ultimately may reduce the gap among construction graduates.

The research used the Research and Development type of research as a research design strategy. The research typology was Exploratory Embedded Mixed-Method Research. The research referred to the Triangulation, Development, and Initiation reasoning to justify the use of the mixed-method. Also, two research philosophy approaches were used in this research: the Normative Approach and Pragmatist Approach.

Four objectives were targeted by this research. The first objective was "*developing and proposing a theoretical framework for designing an effective soft skills curriculum*." This

objective was achieved by defining Design for Six Sigma as a theoretical framework for the study. Details were provided in Chapter 3.

The second objective was "*Developing a soft skills taxonomy and use it to benchmark the existing state of the soft skills gap among construction graduates*." This objective was achieved by proposing 12 soft skills clusters and using the clusters to measure the soft skills gap among construction graduates. Details were provided in Chapters 4 and 5.

The third objective was "*Prioritizing the soft skills taxonomy based on the construction industry need*." This objective was achieved by conducting an industry survey using the soft skills taxonomy and analyzing the survey data using the Gap Score Analysis method and the Quadrant Analysis method. Details were provided in Chapters 5 and 6.

The fourth objective was "*Proposing and verifying an effective soft skills instructional curriculum for construction education*." This objective was the key objective in this research as it addressed the research hypothesis "construction schools were challenged to implement new learning innovations to increase the soft skills level among their graduates." This objective was achieved by using the Six Sigma theoretical framework to design and propose the intended instructional curriculum. Details were provided in Chapters 3, 4, 5, 6, 7, and 8.

The research answered three questions:

1. What is the magnitude of the soft skills gap?

   The research defined the gap using two measurements: the Gap Score and the Sigma Level. The results show that all 12 soft skills clusters have gaps and the graduate sigma level is a noncompetitive Sigma Level.

   The gap score values ranged between 0.24 and 1.27. The largest gap was in "*Cluster #3: Conflict resolution and negotiation skills*." The smallest gap was in "*Cluster #9: Workplace diversit*y."

   The Sigma Level values ranged between 2.00 Sigma and 3.00 Sigma. The highest Sigma Level value was in "*Cluster #9: Workplace diversity skills*." The lowest Sigma Level value was in "*Cluster #9: Conflict resolution and negotiation skills*."

2. Which soft skills matter the most to the industry? And what should be taught to the construction students?

The Gap Score Analysis method and the Sigma Level calculations results were triangulated with the Quadrant Analysis method results. Both Cluster #9: Conflict resolution and negotiation skills and Cluster #1: Communication skills were defined as the critical clusters that need first priority to be addressed among construction students. Further, the results suggest that the construction students should be exposed to all 12 clusters.

3. How do students get help to better cultivate soft skills? And how should these skills be integrated within a construction curriculum?"

   The research proposed a soft skills instructional curriculum. It is suggested that the highest level of soft skills cultivation may occur if all four models were implemented.

   The proposed soft skills curriculum is comprised of four models. The research suggested allocating a stand-alone soft skills course that focuses on teaching the critical clusters as a first instructional curriculum model. The proposed effective curriculum strategies for the first model should be considered during the implementation of this course. Details are provided in Chapter 7.

   For the other three models, the research suggested embedding them in the existing construction curriculum. Further, each soft skills cluster should be defined as a learning outcome for the curriculum and should be mapped to a specific course within the program's plan of study. The proposed effective curriculum strategies should be considered during the implementation of these courses. Details were provided in Chapter 7.

**9.2 Research Contribution:**

This research has several important contributions to the body of knowledge. The research proposed five new coherent contributions: First, it proposed and demonstrated the use of Design for Six Sigma as a useful decision aid framework to implement soft skills in construction curriculum. Second, it proposed and used a novel soft skills taxonomy as a first step toward a soft skills standardization. Third, it benchmarked the existing status of soft skills level among construction graduates. Fourth, it proposed and verified a soft skills instructional curriculum for soft skills education. Finally, this wok contributes greatly to the application of the research method domain.

Further, the research promoted teaching, training, and learning. The results may reinforce the teaching activities of construction in the classrooms at all education levels. It will offer new teaching approaches and new learning resources that will influence undergraduates and students in construction programs, as well as the construction graduates in the marketplace. Furthermore, it will increase the chance of recruiting them and building new generations of future leaders. This will enhance the quality of their life and allow them to play a more constructive role in society.

1. **'Design for Six Sigma' as a Decision Aid Framework:**

To the research knowledge, there is a lack of quantitative tools that can capture the industry's need and convert that quantitative data to a simple, reliable, and very effective curriculum that has indicators for measuring the future development.

The research has shown the merit of using normative-based analytic methods to develop a decision aid tool utilizing Design for Six Sigma (DFSS) to develop a theoretical framework. The theoretical framework provides decision makers with a useful decision-support tool that can be used to effectively implement soft skills in construction education with less amount of human intuition. The research helps to demonstrate the application of structured improvement in academic settings using Design for Six Sigma quality management methodology which is not commonly found.

The framework has an acceptable amount of reliability and validity to be used in future studies. It offers a strong step-by-step holistic guidance to define the soft skills, benchmarks, and prioritizes the existing level of soft skills among construction graduates in entry positions, tests the possible curriculum instructional alternatives, then proposes an effective soft skills instructional curriculum.

The framework offers excellent relationship and a continuous collaboration system between the industry and academia so that the teaching activities of construction will improve and broaden the soft skills taught in the classrooms to correlate with those needed in the marketplace. The tool has the capability to monitor the change in the industry need and effectively respond to those changes.

Also, the framework can be extended to be used in designing specific courses in construction education and/or other disciplines.

2. **The Soft Skills Taxonomy:**

The proposed soft skills taxonomy contributes to the efforts toward soft skills standardization as it considered a large amount of related scholarly work. Also, calculating the six sigma level and the gap score offer construction schools and industry with quantitative data that they can use as a benchmark for their graduates' employees respectively. This benefits all stakeholders involved in the construction context. The positive results and outcomes of this research adds balance and new dimensions for soft skills that will lead to significant improvements in the construction graduates' competencies and capabilities that could be a powerful tool to support construction firms who are continuously aiming for improvement.

The proposed taxonomy is also expected to be used as a means to improve knowledge management among construction stakeholders in two forms. First, it could provide a tool to capture and evaluate soft skills knowledge. Second, it could facilitate a standard soft skills content, definition, interpretations, and approaches in order to more effectively transfer knowledge to construction students. Also, it is anticipated that the proposed taxonomy could be helpful to other scholars in their work related to the soft skills domain.

3. **Benchmark the Existing Status of Soft Skills Gap Among Construction Graduates:**

This research attempted to bridge the gap in the literature by benchmarking the existing status of the soft skills gap among construction graduates and providing quantitative evidence. Two methods of measurements were used to define the gap magnitude for each soft skills cluster as well as for the overall soft skills. The two methods were the Gap Score method and the Sigma Level method. They were used to define a precise magnitude for the soft skills gap.

The benchmark facilitates the continuous quality improvement of the soft skills among the construction graduates. It offers comparative indicators to measure the future development and help each construction school to measure its graduate performance against the existing gap. Also, the existing gap magnitude will open the door for using Design for Six Sigma model in future work. Further, the benchmark measurements can offer a new screening tool for prospective employees and might contribute to the future competitiveness of the construction industry.

### 4. The Soft Skills Curriculum:

The research proposed a soft skills instructional curriculum comprised of four models. Each model has the knowledge content, the implementation priority, the effective instructional strategies in eight curriculum domains, and indicators to measure the future development. The vast majority of construction academia educators are familiar with the proposed solutions. However, to the research knowledge, this is the first time that those solutions were tested with respect to the specific soft skills, and the effective ones were combined to propose an instructional model that has the ability to enhance the cultivation of soft skills among construction graduates. The main contribution, therefore, is not only the possibility of solving soft skills gap in construction context, but also of suggesting tools to improve the education curricula in construction academia. Further, the research suggested a continuous change for this curriculum based on the industry's changing needs.

Given the acceptable amount of reliability and validity achieved through triangulation, it is hoped that the framework will help in bridging the gap between construction graduates and their employers and ultimately facilitating the recruitment of soft skills-ready entry-level construction graduates.

### 5. Contribution to the Application of Research Method:

The research suggested a new application for the concepts of literature-based discovery. Specifically, it suggested that literature-based discovery can be fruitful in defining, grouping, and classifying the soft skills into a novel soft skills taxonomy.

Ganiz et al. (2005) characterized the LBD by four main points: "*using the existing knowledge, developing a process that strives to find connection between wow arguments, the combination of two arguments may yield a new insight that was not originally apparent and any connections made should be novel.*" This research demonstrated the use of a Literature-Based Discovery approach for developing and proposing a novel soft skills' taxonomy. The research combined three sources of knowledge: the hidden knowledge across the 32 scholarly documents, the authors' experiential knowledge, and feedback from academia and industry through a structured approach that utilized survey and interviews. The feedback process offered the needed validity for the taxonomy and ensured to cover any possible gaps that may have been missing in the 32 scholarly documents reviewed.

### 9.3 Research Limitations:

This study was limited to the following:

1. As previously discussed in Chapter 3 and Chapter 4, the scope of this study was unified by the structural curriculum theory which defines the worthwhile subject matter selection method and justification for the process. Also, it explains how to organize the meaningful knowledge within a curriculum framework so that it transforms that knowledge into rigorous and relevant quality learning activities and instructional standards that will help educators better prepare construction students for future industry career opportunities. Therefore, the research outcomes didn't suggest a detailed syllabus. The research only addressed the effective soft skills instructional guidelines that will ultimately increase the soft skills cultivation among the construction graduates.
2. The research used a non-probability convenient sampling method for the structured interviews and to solicit and capture feedback from experts. It used stratified random sampling for the industry survey; thus, the results generalization was limited to the research sample only.
3. As previously discussed in Chapter 3, the research relied on Dr. Akao's model and used only the construction industry as an evaluator for the soft skills outcomes of construction schools. The research did not interact with construction students, assuming that the literature review covers their learning needs.
4. The research did not call for international data input. While some information acquired from international literature was used to strengthen the research, the study focused on the soft skills gap within the United States construction industry. Scholars from other countries should collect different and additional data to define and address the soft skills gap specific for their geographical location.
5. The study did not implement and test the proposed instructional curriculum. This was out of the research scope.

### 9.4 Future Research:

Given that this research is an exploratory study, it raises additional questions. In Chapter 3, the research discussed the philosophical assumptions for the research. The research suggested that the transformation of the proposed theoretical framework to a "normative problem–specific"

framework occurred after the verify phase. This argument was based on Routio (1999) understanding of the normative research. Also, based on the same argument, the "normative problem–specific" framework can be turned into a "general normative" framework after a future series of correction and validation by other construction scholars. This argument is also valid for the soft skills taxonomy. The proposed soft skills instructional curriculum may not become a general normative even with a broad acceptance by construction education. This is because each time a scholar repeats the process, the framework will generate different outcomes, due to the continuous changes in the industry's needs expected from the evolving construction industry in the US.

The research suggests several future research tasks that may include:

1. Evaluate the proposed soft skills instructional curriculum models in the actual classroom to determine the impact on soft skills cultivation. This should be followed by comparing the construction graduates' soft skills level between students with traditional educational curriculum and the proposed curriculum models.
2. The research proposed a soft skills taxonomy comprised of 12 soft skills clusters that have a clear vocabulary. The taxonomy can serve as a key skeleton to measuring the soft skills cultivation among the construction students, graduates, or any employee in the industry. The statistical analysis for the industry survey data (Chapter 5) showed strong correlations between all 12 clusters as variables and the overall soft skills variable. Also, it showed weak correlations among the 12 clusters. This suggests that some of the 12 clusters are mutually reinforcing each other: they interlock and overlap. Therefore, advancement in one cluster may be achieved by the improvement of another cluster(s). Future research should clearly define the interrelation among these 12 clusters, and more importantly, continual development and update to the 12 clusters.
3. Develop assessment tools to measure the soft skills cultivation among the students. These tools can be used to measure the soft skills levels in incoming freshman and then test them again before graduation.
4. Mapping the proposed soft skills instructional models with the applicable course titles in current construction curricula considering the budgetary issues such as limited funding, instructors, and resources.

5. Examine the benefits of collecting survey data from construction students, educators, and compare the results with industry's needs.
6. Develop assessment tools for construction students' achievements that include the soft skills knowledge. It is important to define the percentage of soft skills knowledge achievement against technical knowledge achievement. This may be developed based on the construction industry's assessment of the construction graduate's performance in both soft and technical skills.
7. Document and analyze the construction industry's best practices in soft skills advancement in order to use the results to reinforce the academic efforts and also to promote these best practices among construction industry stakeholders.

### 9.5 Future Applications:

In Chapter 2, the research discussed the challenges that contribute to the soft skills gap. One of those challenges is "*Soft skills are regarded as less important than technical skills by construction higher education accreditation bodies.*" The research findings highlight the existence of soft skills gap among construction graduates and provide the construction scholars with the quantitative proof to be aware of the construction industry's actual need of soft skills as well as the magnitude of the gap. The research argues that construction accreditation institutes, as a higher level of decision support, should update their standards.

For example, the American Council for Construction Education (ACCE) has its standards for accrediting baccalaureate construction programs. The standards' document is very broad. The changes may be conducted to Document 102 OBS (Manual for Preparation of the Self-Evaluation) (ACCE 2015). The changes may include:

- Rewrite the Student Learning Outcomes that are in Section 3.1 '*Requirements*'. The outcomes: outcome #1, outcome #2, outcome #4, outcome #6 and outcome #10 may be removed and the 12 soft skills clusters may be added to the standards as new learning outcomes.
- Add sections that ask the construction program to provide a matrix that maps each soft skill learning outcome (12 soft skills outcomes) and a specific course within the program. This may be added to section 3.2 "*Courses Delivered by Alternate Forms of Delivery.*"

- Propose the Six Sigma quality plan as a conscious improvement quality tool in sections (9.1.1 and 9.1.3).
- Develop training workshops for educators in construction programs on how to develop and implement Six Sigma projects that are aimed for soft skills development.

The theoretical framework may be adopted in the future to develop a computer application. The future use of this computerized application will not be limited to the soft skills curriculum or construction context; it can also include designing technical and non-technical courses/ curricula.

Further, the research results may be extended to be used in the construction industry education. For example, the proposed decision aid framework may be adopted as a training needs assessment tool whereas the industry can benchmark the soft skills gap among managers/ employees in order to develop effective training programs. This would offer better allocation for the human and financial resources in the industry.

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# APPENDICES

**Appendix ‘A’: The As Is Soft Skills List**

| # | Extracted Soft Skills | # of skills |
|---|---|---|
| **1** | The ability to communicate, both orally and in writing; ethics; the understanding of human behavior; problem solving; teamwork; resource allocation and management; creativity; and continuous learning. | **9** |
| **2** | An ability to function effectively as a member or leader on a technical team; an ability to identify, analyze, and solve broadly-defined engineering technology problems; an ability to apply written, oral, and graphical communication in both technical and non-technical environments; an ability to identify and use appropriate technical literature; an understanding of the need for and an ability to engage in self-directed continuing professional development; an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity; a knowledge of the impact of engineering technology solutions in a societal and global context; and commitment to quality, timeliness, and continuous improvement. | **8** |
| **3** | Reading; writing; listening; speaking; creative thinking; decision making; problem solving; seeing things in the mind's eye; knowing how to learn; reasoning; responsibility; self-esteem; sociability; self- management; integrity/honesty; wisely using time, money, materials and facilities, and human resources; team member participation; teaching others; exercising leadership; negotiating; and working with diversity. | **21** |
| **4** | Ethics; initiative; judgment; positive attitude; self-confidence; strong work ethic; teamwork; time management; conflict management; good communications skills; planning; problem solving; analytical skills; accepting criticism; accepting diversity; flexibility; adaptability; and adversity. | **18** |
| **5** | Learning to learn; listening communication; oral communication; adaptability; creative thinking ; problem-solving; personal management; self-esteem; goal setting; motivation; personal career development; group effectiveness; interpersonal skills; negotiation; teamwork; influence; organizational effectiveness.. | **18** |
| **6** | Think creatively; work creatively with others; implement innovations; critical thinking ; problem solving; reason effectively; use systems thinking; make judgments; make decisions; solve problems; communicate clearly; collaborate with others; adapt to change; be flexible; manage goals; manage time; work independently; be self-directed learners; interact effectively with others; work effectively in diverse teams; manage projects; produce results; guide and lead others; and be responsible to others. | **24** |
| **7** | Communication in the mother tongue; learning to learn; effective management of time; effective management of information; social and civic competences; sense of initiative; entrepreneurship; creativity; innovation; risk-taking; the ability to plan and manage projects in order to achieve objectives; achieve objectives; awareness of ethical values; promote good governance; and cultural awareness. | **15** |
| **8** | Communication skills; teamwork skills; problem solving skills; self-management skills; planning and organizing skills; life-long learning skills; initiative skills; and enterprise skills. | **8** |
| **9** | Communicate; manage information; think, solve problems; demonstrate positive attitudes and behaviors; be responsible; be adaptable; learn continuously; work with others; participate in projects and tasks. | **9** |
| **10** | Communication skills; teamwork skills; problem-solving skills; initiative and enterprise skills; planning and organizing skills; self-management skills; learning skills; personal attributes; loyalty; personal presentation; commitment; common sense; honesty; integrity; positive self-esteem; enthusiasm; sense of humor; reliability; ability to deal with pressure; balanced attitude to work and home life; adaptability; and motivation. | **22** |

| | | |
|---|---|---|
| **11** | Oral communication; written communication; critical thinking; negotiation; creativity; innovation; professionalism; work ethic; life-long learning; self-direction; networking; collaboration; working with cultural diversity; critical thinking; problem solving; diversity; ethics; and social responsibility. | **18** |
| **12** | Achievement orientation; high self-esteem; integrity; resilience; initiative; self-awareness, self-objectivity; emotional self-control; personal presentation; managing time successfully; lifelong learning; strong work ethic; problem solving; decision-making skills, critical thinking, creative thinking; good human relations, communication skills, teamwork skills, customer service, and orientation. | **21** |
| **13** | Analytical thinking; buy in and advocacy; coaching; coping; delegation; facilitation; professional judgment; ethical judgment; social awareness; systematic problem solving; vision and goal settings; working in partnership client; negotiations; public speaking; and organizational management. | **15** |
| **14** | Knowledge of ethical responsibility; awareness of ethical conduct and ability; professionalism; creative problem solving; research; analytical skills; social skills; people skills; conflict resolution; professional responsibility; leadership and management; adaptability; ability to learn; risk management; collaborative skills; teams and teamwork; communication; writing skills; and verbal communication. | **19** |
| **15** | Able to solve problems; able to speak and communicate well with other people; able to work with people in teams; self-confident; and adaptable to change at work. | **5** |
| **16** | Oral communication; written communication; motivation of others; decision making; supervision of others; team building; managing time; setting objectives and goals; conducting meetings; managing conflict; managing crisis; delegating responsibilities; managing other national cultures; strategic planning; public relations; identifying personal strengths and weaknesses; productivity maintenance and control; managing change; organization of communication systems; managing job stress; negotiation; and creativity. | **22** |
| **17** | Having customer focus; able to challenge how things are done; able to solve conflict; having practical focus; able to speak and communicate well with other people; able to collect, analyze and organize information; able to solve problems; able to read, spell and write well; able to work with other people in teams. | **10** |
| **18** | Self-management ability; information application ability; resource management ability; problem solving ability; communication ability; cooperative ability; understand management system including international trend; conflict management ability; negotiation ability; customer service ability; work ethic; and understand organization systems. | **12** |
| **19** | Communication skills; presentation; general and business correspondence; public speaking; report writing; delegation; negotiation; decision making; motivation and promotion; team working; time management; top management relations; chairing meetings; understanding of organizations; public relations; strategic planning; and human behavior. | **17** |
| **20** | Achievement orientation; analytical thinking; assertiveness; change management; communication skills; conceptual thinking; concern for order; conflict management; customer service orientation; developing others; influencing skills; information seeking; initiative; decisiveness; integration; interpersonal understanding; negotiation skills; organizational awareness; organizational commitment; relationship management; seeks opportunities to improve; strategic thinking and team working. | **23** |
| **21** | Oral communication, written communication; critical thinking; problem solving; self-management; working independently; learning independently; taking responsibility for personal actions; teamwork and global citizenship. | **10** |

| | | |
|---|---|---|
| **22** | Self-awareness; emotional self-awareness; accurate self-assessment; self-confidence; self-management; self-control; transparency; adaptability; achievement; initiative; optimism; social awareness; empathy; organizational awareness; service relationship management; inspiration; influence; developing others; change catalyst; conflict management; teamwork; and collaboration. | **22** |
| **23** | Communication skills; motivating and promoting; honesty; development of trust; self-awareness; emotional balance; understanding of values; problem identification and solving; team work; delegation; and flexibility. | **10** |
| **24** | Oral communications; written communications; group dynamic; running a meeting; ethics; negotiations; stress management; career planning; time management; accountability; initiative; outcome oriented; problem identifier and solver; diplomacy; and collaborative. | **15** |
| **25** | Collaboration; teamwork; communication skills; initiative; leadership ability; personal effectiveness; personal mastery; people development; coaching; planning and organizing; and presentation skills. | **11** |
| **26** | Communication skills; critical thinking; teamwork; professionalism; life-long learning; and entrepreneurship. | **6** |
| **27** | Ethical; willing to learn; team player; flexible; problem solving; teamwork; negotiation; able to work under stress; able to manage tasks; able to complete work; able to lead and inspire. | **11** |
| **28** | Reflection; learning to learn; commitment to the organization; self-criticism, handling emotions; coping with complexity; ethical responsibility; trustworthiness; conscientiousness; self-awareness; adaptability; critical thinking; liability; inspiring people; mediation; coaching; team learning skills; teamwork; sharing visions; creating a learning climate; communication; persuasion; negotiation; and establishing relationships. | **24** |
| **29** | Communication Skills; team building; flexibility; creativity; motivate people; influence others; decision making; critical thinking; organizational effectiveness; stress management; time management; change management; trustworthiness; conflict management. | **14** |
| **29** | Communication skills; team building; flexibility; creativity; motivate people; influence others; decision making; critical thinking; organizational effectiveness; stress management; time management; change management; trustworthiness; conflict management. | **15** |
| **30** | Enthusiasm; teamwork; flexibility; communication skills; time management; coordination and organization; acquiring new knowledge; creativity; analytical skills; job analysis and negotiation skills. | **11** |
| **31** | Allocate time; allocate money; allocate human resources; interpret information; serve clients & customers; participate as team member; work with diversity; exercise leadership; negotiate a decision; teach others; listening; speaking; thinking skills; problem solving; reasoning; knowing how to learn; decision making; creative thinking; seeing in mind's eye; integrity; honesty; responsibility; self-management; social skills; self-esteem. | **25** |
| **32** | Problem recognition and solving; risk and uncertainty; communication; globalization; teamwork; lifelong learning; professional and ethical responsibility; attitudes and contemporary issues. | **9** |
| | **Total Skills** | **497** |

**Appendix ‘B’: Soft Skills Inventory List**

| Skill Title | Frequent | Other Terminologies That Communicate The Same Skill |
|---|---|---|
| | Filter #1 | Filter #2 |
| **Ability to deal with pressure** | **1** | - |
| **Able to lead and inspire** | **1** | Leadership ability |
| **Able to manage tasks** | **1** | Manage projects |
| **Accepting criticism** | **1** | - |
| **Accurate self-assessment** | **1** | Self-criticism; self-objectivity; identifying personal strengths/weaknesses |
| **Achievement** | **2** | Achievement orientation; achieve objectives; produce results; able to complete work; commitment to quality, timeliness, and continuous improvement; ability to plan and manage projects in order to achieve objectives |
| **Adaptability** | **6** | Adapt to change; be adaptable; being adaptable to change at work |
| **Adversity** | **1** | - |
| **Allocate resources** | **0** | Allocate human resources; allocate money; wisely uses money, materials and facilities, and human resources; resource allocation and management; resource management ability |
| **Analytical thinking** | **2** | Analytical skills |
| **Assertiveness** | **1** | - |
| **Awareness of ethical values** | **1** | Understanding of values |
| **Be responsible to others** | **1** | Be responsible |
| **Buy in and advocacy** | **1** | - |
| **Change catalyst** | **1** | - |
| **Change management** | **3** | Managing change |
| **Coaching** | **3** | Creating a learning climate |
| **Collaboration** | **3** | Collaborate with others; collaboration skills |
| **Commitment to the organization** | **1** | Commitment |
| **Common sense** | **1** | - |
| **Communication skills** | **11** | Communicate; communicate clearly; communication; communication in the mother tongue; being able to speak and communicate well with other people; good communications skills; organization of communication systems; interact effectively with others; an ability to apply written, oral, and graphical communication in both technical and non-technical environments |
| **Conceptual thinking** | **1** | - |
| **Concern for order** | **1** | - |
| **Conflict management** | **1** | Conflict management ability; managing conflict |
| **Conflict resolution** | **1** | Being able to solve conflict |

| | | |
|---|---|---|
| **Conscientiousness** | **1** | - |
| **Cooperative ability** | **1** | - |
| **Coping with complexity** | **1** | Coping |
| **Creating learning environment** | **1** | - |
| **Creativity** | **7** | Creative thinking; creative problem solving; think creatively; able to challenge how things are done |
| **Critical thinking** | **1** | - |
| **Cultural awareness** | **1** | Managing other national cultures; working with cultural diversity; participate in an effective and constructive way in diverse societies |
| **Customer service** | **3** | Customer service ability; customer service and orientation; customer service orientation; public relations; having customer focus; serve clients & customers |
| **Decision making** | **6** | Decision making skills; negotiate a decision; make judgments; judgment; make decisions; professional judgment |
| **Decisiveness** | **1** | - |
| **Delegation** | **3** | Delegating responsibilities |
| **Developing others** | **2** | People development |
| **Diplomacy** | **1** | - |
| **Empathy** | **1** | - |
| **Enterprise skills** | **2** | - |
| **Enthusiasm** | **2** | - |
| **Entrepreneurship** | **2** | - |
| **Ethical issues** | **1** | - |
| **Ethical judgment** | **1** | |
| **Ethical responsibility** | **3** | knowledge of ethical responsibility; accountability |
| **Facilitation** | **1** | - |
| **Flexibility** | **5** | Flexible; be flexible |
| **Global citizenship** | **1** | Globalization; attitudes and contemporary issues; knowledge of the impact of engineering technology solutions in a societal and global context |
| **Goal setting and management** | **0** | Manage goals; setting objectives and goals, goals settings |
| **Group dynamic** | **1** | - |
| **Group effectiveness** | **1** | - |
| **Having practical focus** | **1** | - |
| **Honesty** | **4** | - |
| **Influence others** | **2** | Influence; influencing skills; guide and lead others; supervision of others; inspiration |
| **Information resources management** | **0** | Being able to collect, analyze and organize information; information seeking; manage information; effective management of information; information application ability; |

| | | |
|---|---|---|
| | | interpret information; research; an ability to identify and use appropriate technical literature |
| **Initiative** | **9** | Initiative skills; sense of initiative |
| **Innovation** | **3** | Initiative skills; implement innovations |
| **Inspiring people** | **1** | - |
| **Integration** | **1** | - |
| **Integrity** | **4** | - |
| **Job analysis** | **1** | - |
| **Liability** | **2** | - |
| **Life-long learning** | **3** | Life-long learning skills; learning to learn learning skills; knowing how to learn; be self-directed learners; learning independently; willing to learn; acquiring of new knowledge; continuous learning; lifelong learning; ability to learn |
| **Listening communication** | **0** | Listening |
| **Loyalty** | **1** | - |
| **Mediation** | **1** | - |
| **Meetings skills** | **0** | Chairing meetings; conducting meetings; running a meeting |
| **Motivate people** | **2** | Motivation; motivation and promotion; motivation of others |
| **Negotiation** | **10** | negotiation ability; negotiation skills; negotiate |
| **Optimism** | **1** | - |
| **Organizational awareness** | **2** | - |
| **Organizational management** | **1** | Organizational commitment; organizational effectiveness; understand organization systems; understanding of organization; understand management system including international trends |
| **Outcome oriented** | **1** | - |
| **Participate in projects and tasks** | **1** | - |
| **Personal presentation** | **2** | - |
| **Persuasion** | **1** | - |
| **Planning and organizing skills** | **2** | Planning; planning and organizing; coordination and organization; organizing skills |
| **Positive attitude** | **2** | Demonstrate positive attitudes and behaviors; balanced attitude to work and home life; sense of humor |
| **Presentation skills** | **2** | Presentation |
| **Problem solving** | **14** | Problem solving ability; problem solving skills; problem identification and solving; problem identifier and solver; problem recognition and solving; an ability to identify, analyze, and solve broadly-defined engineering technology problems; being able to solve problems, solve problems; systematic problem solving |
| **Productivity maintenance and control** | **1** | - |
| **Professionalism** | **3** | Professional responsibility |

| | | |
|---|---|---|
| **Promote good governance** | **1** | - |
| **Reading communication** | **0** | Being able to read; reading |
| **Reasoning** | **2** | Reason effectively |
| **Reflection** | **1** | - |
| **Relationship management** | **2** | Service relationship management; networking; sociability; top management relations; good human relations; establishing relationships |
| **Reliability** | **1** | - |
| **Resilience** | **1** | - |
| **Responsibility** | **3** | Taking responsibility for personal actions |
| **Risk-management** | **3** | Risk and uncertainty; risk-taking |
| **Seeing things in mind's eye** | **2** | Seeing in mind's eye |
| **Self-awareness** | **5** | Emotional self-awareness |
| **Self-confidence** | **2** | Being self-confident |
| **Self-control** | **2** | Emotional balance; emotional self-control; handling emotions |
| **Self-direction** | **1** | Work independently, personal management; personal effectiveness; personal mastery; personal career development; seeks opportunities to improve; an understanding of the need for and an ability to engage in self-directed continuing professional development; career planning, working independently; promoting skills |
| **Self-esteem** | **5** | High self-esteem; positive self-esteem |
| **Self-management** | **4** | Self-management ability; self-management skills |
| **Sharing visions** | **1** | - |
| **Social awareness** | **2** | - |
| **Social responsibility** | **1** | - |
| **Social skills** | **2** | Social and civic competences |
| **Speaking communication** | **0** | Oral communication; oral communications; public speaking; speaking; verbal communication; the ability to communicate orally |
| **Strategic planning** | **2** | Strategic thinking; vision and goal settings |
| **Stress management** | **3** | Able to work under stress; managing job stress; managing crisis |
| **Teach others** | **1** | Teaching others |
| **Team building skills** | **3** | - |
| **Team learning skills** | **1** | - |
| **Teamwork** | **12** | Teamwork skills; teams and teamwork; team player; team work;<br>team working; work effectively in diverse teams; team member participation; an ability to function effectively as a member or leader on a technical team; participate as team member |

| | | |
|---|---|---|
| **The understanding of human behavior** | **1** | Human behavior; interpersonal understanding; personal attributes; interpersonal skills; people skills |
| **Thinking skills** | **1** | Think |
| **Time management** | **6** | Manage time; managing time successfully; allocate time; effective management of time; managing time |
| **Transparency** | **1** | - |
| **Trustworthiness** | **3** | Development of trust |
| **Use systems thinking** | **1** | - |
| **Work ethics** | **3** | Strong work ethic; an understanding of and a commitment to address professional and ethical responsibilities; ethics; awareness of ethical conduct and ability |
| **Work with diversity** | **1** | Accept diversity; respect for diversity; diversity |
| **Work with others** | **1** | Being able to work with other people in teams; being able to work with people in teams; work creatively with others |
| **Working in partnership client** | **1** | - |
| **Writing communication** | **0** | Writing; writing skills; being able to spell and write well; general and business correspondence; report writing; the ability to communicate in writing |

**Appendix ‘C’: LISA Report:**

**The survey instrument validity and reliability:** The construct validity and reliability of the industry survey has been analyzed using the Statistical Package for Social Science (SPSS: IBM Corporation) software. In particular, principal component analysis and Monte Carlo parallel analysis were used to examine the construct validity of the survey, and Cronbach's alpha was subsequently used to examine the reliability of the survey. The analysis revealed the following:

**a) Construct Validity Analysis**

In the context of this study, construct validity examines the constructs (i.e., dimensionality) of the survey. Although survey questions concern 12 theoretical clusters of skills, correlations among items indicated that there were modest to moderate levels of overlaps across these items (r = .23 to .55 for importance items; r = .19 to .60 for satisfaction items). Principal component analysis with direct oblimin rotation and Monte Carlo parallel analysis suggested that the survey measured two dimensions: satisfaction (component 1) and importance (component 2). These two components were modestly correlated (r = .19), and they together explained 47% of the total variance across all survey items. In particular, all satisfaction items for the 12 theoretical clusters loaded on the satisfaction component, and all importance items loaded on the importance component (see Table 1 for component loadings). Component scores were subsequently calculated by averaging the 12 item scores within each dimension. Finally, correlations between the two component scores and the 2 questions assessing the overall satisfaction and overall importance were calculated. The satisfaction component was substantially correlated with the overall satisfaction score at r = .79, and the importance component was substantially correlated with the overall importance score at r = .71. Cross-domain correlations were low (r = .18 and .16, respectively).

Overall, the results indicated that although 12 clusters of soft skills were proposed theoretically, participants' responses using the current survey do not support these 12 clusters as separate and independent dimensions. Rather, participants' responses on the importance of the 12 soft skill clusters "covary" to a great extent such that they were captured by one single dimension that captured the importance of the overall soft skill. Similarly, participants' responses on their satisfaction with the 12 soft skill clusters were also mutually dependent, and responses using the current survey suggested only one dimension that captured the satisfaction with the overall soft skills. However, it is important to note that such analyses in no ways suggested that the 12

theoretical clusters were practically redundant or meaningless. The two components from the current analyses only captured less than 50% of the total variance of all 12 clusters. Therefore, it is still yet to be determined by future research whether the 12 clusters would perform better than the 1 single dimension in practice in terms of their predictive validity, benefit-cost ratio, etc.

**b) Reliability**

Based on the results of the principal component analysis, we further calculated the Cronbach's alpha to examine the reliability (i.e., internal consistency) of the scale with respect to each of the two dimensions. The possible range for Cronbach's alpha is from 0 to 1 with higher numbers indicating better internal consistency. In the current study, the Cronbach's alpha was .90 and .89, respectively, for the satisfaction scale and the importance scale, suggesting great internal consistency within each dimension.

**Appendix ‘D’:  The Structured Interview Spreadsheets**

## The Structured Interview Matrix Rated By Respondent #1

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 |
| Method of course delivery: | Online class | **W** | **W** | **W** | **W** | **M** | **M** | **M** | **M** | **W** | **S** | **M** | **W** |
| | Face-to-face class ( could be hybrid | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **W** | **S** | **M** | **M** |
| | Integrated in curriculum (or capstone) | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **M** | **S** | **S** | **S** | **S** |
| | Learning contract | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **W** | **M** | **M** | **M** |
| | Accelerated class | **W** | **M** | **M** | **W** | **S** | **M** | **M** | **M** | **W** | **M** | **M** | **W** |
| The pedagogical approach: | Traditional education | **M** | **M** | **W** | **W** | **M** | **M** | **W** | **W** | **W** | **M** | **W** | **W** |
| | Roll playing/simulation-based learning | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **W** | **M** |
| | Problem/project based learning | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **M** | **S** | **S** | **M** |
| | Reflection learning | **W** | **M** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **S** | **S** |
| | Game-based learning. | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| Course assessment: | Presentations | **S** | **M** | **W** | **M** | **M** | **M** | **M** | **W** | **M** | **M** | **M** | **M** |
| | Portfolios reports | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **W** | **M** | **M** | **M** | **M** |
| | Self-assessment and peer-assessment | **S** | **M** | **S** | **S** | **M** | **M** | **M** | **W** | **M** | **W** | **S** | **S** |
| | Online tools | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Assignments, reports and projects | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **M** | **W** | **W** | **W** | **W** |
| Course feedback: | Course blog | **M** | **W** | **W** | **W** | **W** | **M** | **W** | **W** | **W** | **M** | **M** | **M** |
| | Formal University student feedback process | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **M** |
| | End of course discussion | **M** | **M** | **W** | **M** | **W** | **M** | **W** | **W** | **M** | **W** | **M** | **M** |
| | Course wiki and. | **M** | **W** | **W** | **W** | **W** | **M** | **W** | **W** | **W** | **W** | **M** | **M** |
| | Course forum | **M** | **M** | **M** | **M** | **W** | **M** | **W** | **W** | **W** | **W** | **M** | **M** |
| Student academic level: | Freshman level | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Sophomore level | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Junior level | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Senior level | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Mixed level: two levels or more | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| Learning resources: | Handouts material | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Text book(s), | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Manual book(s), | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Case studies | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Learning management system | **M** | **W** | **W** | **W** | **M** | **M** | **W** | **W** | **W** | **W** | **W** | **W** |
| Classroom size and layout: | Over-sized class (>25) | **W** | **W** | **W** | **W** | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **M** |
| | Regular class (20 -25) | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Small class (<20) | **M** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **S** | **S** |
| | One cluster setting | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Small clusters setting | **S** | **S** | **S** | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** |
| Instructor(s) background: | Competent instructor from academia | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Group of instructors from academia | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Speakers from industry | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Trainers from industry | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Instructor from academia with industry experience | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #2

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 |
| Method of course delivery: | Online class | **W** | **M** | **W** | - | - | **M** | - | **W** | - | **M** | **M** | - |
| | Face-to-face class ( could be hybrid | **S** | **S** | **M** | **W** | **W** | **M** | - | **M** | - | **M** | **M** | **M** |
| | Integrated in curriculum (or capstone) | **S** | **S** | **M** | **W** | **W** | **M** | - | **M** | - | **M** | **M** | - |
| | Learning contract | **M** | **S** | **S** | **S** | **W** | **S** | - | **S** | **S** | **M** | **M** | **W** |
| | Accelerated class | **W** | **M** | - | - | - | - | - | - | - | - | - | - |
| The pedagogical approach: | Traditional education | **M** | **W** | **W** | **W** | - | **W** | **W** | **M** | **W** | **W** | **W** | - |
| | Roll playing/simulation-based learning | **W** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Problem/project based learning | **S** | **S** | **S** | **S** | **W** | **S** | **S** | **S** | **W** | **S** | **S** | **S** |
| | Reflection learning | **M** | **S** | **M** | **M** | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **S** |
| | Game-based learning. | **W** | **S** | **S** | **M** | **W** | **S** | **S** | **S** | **W** | **S** | **M** | - |
| Course assessment: | Presentations | **S** | **W** | - | - | - | **M** | **W** | **W** | - | - | **W** | **W** |
| | Portfolios reports | **M** | **M** | - | - | - | **M** | **M** | **W** | - | - | **W** | - |
| | Self-assessment and peer-assessment | **S** | **S** | **S** | **M** | - | **S** | **W** | **W** | - | - | **M** | **S** |
| | Online tools | **W** | **W** | - | - | - | - | - | - | - | - | - | - |
| | Assignments, reports and projects | **S** | **S** | **W** | - | - | **S** | **W** | **W** | - | **S** | **M** | - |
| Course feedback: | Course blog | **W** | - | **W** | **M** | - | - | - | **M** | **S** | - | **W** | - |
| | Formal University student feedback process | - | - | - | - | - | - | - | **M** | - | - | - | - |
| | End of course discussion | **W** | **M** | **W** | **W** | - | - | - | **M** | **W** | - | **W** | - |
| | Course wiki and. | **S** | **W** | **M** | **M** | - | - | - | **M** | **S** | - | **M** | - |
| | Course forum | **S** | **M** | **M** | **M** | - | - | - | **M** | **S** | - | **M** | - |
| Student academic level: | Freshman level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Sophomore level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Junior level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Senior level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Mixed level: two levels or more | - | - | - | - | - | - | - | - | - | - | - | - |
| Learning resources: | Handouts material | **M** | **W** | **W** | **W** | - | **W** | **W** | **M** | **W** | **M** | **W** | - |
| | Text book(s), | **M** | **W** | **W** | **W** | - | **W** | **W** | **M** | **W** | **M** | **W** | - |
| | Manual book(s), | **M** | **W** | **W** | **W** | - | **W** | **W** | **M** | **W** | **M** | **W** | - |
| | Case studies | **W** | **S** | **M** | **M** | - | **M** | **S** | **M** | **W** | **S** | **M** | - |
| | Learning management system | - | - | - | - | - | - | - | - | - | - | - | - |
| Classroom size and layout: | Over-sized class (>25) | **W** | **W** | **S** | **W** | **W** | **M** | - | **W** | - | **W** | **W** | - |
| | Regular class (20 -25) | **M** | **M** | **S** | **W** | **M** | **M** | - | **M** | - | **M** | **M** | - |
| | Small class (<20) | **S** | **S** | **S** | **S** | **S** | **S** | - | **S** | - | **S** | **S** | - |
| | One cluster setting | - | - | - | - | - | **S** | - | **S** | - | - | - | **S** |
| | Small clusters setting | **S** | - | **S** | **S** | **S** | **S** | - | **S** | - | **S** | **S** | **S** |
| Instructor(s) background: | Competent instructor from academia | **S** | **M** | - | **W** | - | **S** | **M** | **W** | - | - | **W** | - |
| | Group of instructors from academia | **S** | **M** | - | **W** | - | **S** | **M** | **W** | - | - | **W** | - |
| | Speakers from industry | - | **M** | - | **W** | - | **S** | **M** | **W** | - | - | **W** | - |
| | Trainers from industry | - | **M** | - | **W** | - | **S** | **M** | **W** | - | - | **W** | - |
| | Instructor from academia with industry experience | - | **M** | - | **W** | - | **S** | **M** | **W** | - | - | **W** | - |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #3

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** | **C10** | **C11** | **C12** |
| Method of course delivery: | Online class | M | M | W | W | W | M | M | M | - | M | M | M |
| | Face-to-face class ( could be hybrid | S | M | M | M | M | M | M | M | M | M | M | M |
| | Integrated in curriculum (or capstone) | S | S | M | S | M | S | S | S | M | M | S | S |
| | Learning contract | S | M | M | M | M | M | M | M | M | M | M | M |
| | Accelerated class | S | W | W | M | S | S | S | M | W | M | M | M |
| The pedagogical approach: | Traditional education | M | M | M | M | M | M | M | M | M | M | M | M |
| | Roll playing/simulation-based learning | S | S | S | S | M | M | M | S | M | M | M | M |
| | Problem/project based learning | S | S | S | S | M | M | W | M | W | S | M | M |
| | Reflection learning | S | S | M | M | M | M | M | M | M | M | M | M |
| | Game-based learning. | W | M | M | S | M | M | M | M | - | M | M | M |
| Course assessment: | Presentations | S | S | W | M | M | M | M | M | M | M | M | M |
| | Portfolios reports | S | M | W | W | W | M | M | W | W | S | M | M |
| | Self-assessment and peer-assessment | M | M | M | M | M | M | M | M | M | M | M | M |
| | Online tools | W | - | - | W | W | M | W | M | - | M | M | M |
| | Assignments, reports and projects | M | M | M | M | W | M | M | M | - | M | M | M |
| Course feedback: | Course blog | S | W | W | W | M | M | W | M | W | M | M | M |
| | Formal University student feedback process | M | W | W | W | W | M | - | M | W | W | - | M |
| | End of course discussion | M | S | S | M | M | S | - | M | W | W | M | M |
| | Course wiki and. | S | W | W | W | M | M | W | M | W | M | M | M |
| | Course forum | M | M | W | M | M | M | - | - | - | M | M | M |
| Student academic level: | Freshman level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Sophomore level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Junior level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Senior level | - | - | - | - | - | - | - | - | - | - | - | - |
| | Mixed level: two levels or more | - | - | - | - | - | - | - | - | - | - | - | - |
| Learning resources: | Handouts material | M | W | - | - | - | M | - | - | - | M | M | M |
| | Text book(s), | W | W | W | W | W | W | W | M | W | M | M | M |
| | Manual book(s), | W | M | - | W | - | M | - | M | - | M | M | M |
| | Case studies | M | S | M | M | W | M | - | M | M | M | M | M |
| | Learning management system | S | M | - | M | - | M | - | M | - | M | M | M |
| Classroom size and layout: | Over-sized class (>25) | W | W | W | W | M | W | W | M | W | M | M | M |
| | Regular class (20 -25) | M | M | M | S | M | M | M | M | M | M | M | M |
| | Small class (<20) | S | M | M | M | M | M | M | S | M | S | M | M |
| | One cluster setting | M | W | M | M | M | M | M | M | M | M | M | M |
| | Small clusters setting | S | S | M | S | M | M | M | M | M | M | M | M |
| Instructor(s) background: | Competent instructor from academia | M | M | M | M | M | M | M | M | M | M | M | M |
| | Group of instructors from academia | S | S | S | M | M | M | M | M | M | S | M | M |
| | Speakers from industry | S | S | W | - | - | S | S | M | M | M | M | M |
| | Trainers from industry | W | M | M | W | W | M | M | M | M | M | M | M |
| | Instructor from academia with industry experience | M | M | M | M | M | M | M | M | M | M | M | M |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #4

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** | **C10** | **C11** | **C12** |
| Method of course delivery: | Online class | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Face-to-face class ( could be hybrid | **S** | **W** | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Integrated in curriculum (or capstone) | **S** | **S** | **W** | **W** | **W** | **W** | **W** | **S** | **S** | **M** | **S** | **S** |
| | Learning contract | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Accelerated class | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **W** | **W** | **W** | **W** | **W** |
| The pedagogical approach: | Traditional education | **W** | **W** | **W** | **W** | **W** | **M** | **M** | **M** | **M** | **S** | **W** | **S** |
| | Roll playing/simulation-based learning | **M** | **M** | **M** | **M** | **S** | **S** | **S** | **S** | **M** | **W** | **S** | **S** |
| | Problem/project based learning | **M** | **M** | **M** | **M** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **S** |
| | Reflection learning | **S** | **S** | **S** | **S** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** |
| | Game-based learning. | **S** | **S** | **S** | **S** | **W** | **M** | **M** | **W** | **W** | **M** | **M** | **M** |
| Course assessment: | Presentations | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **W** | **W** | **S** | **S** | **S** |
| | Portfolios reports | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **S** | **W** |
| | Self-assessment and peer-assessment | **S** | **S** | **S** | **S** | **S** | **W** | **W** | **W** | **W** | **M** | **S** | **W** |
| | Online tools | **S** | **S** | **M** | **S** | **M** | **W** | **M** | **W** | **W** | **S** | **M** | **M** |
| | Assignments, reports and projects | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **M** | **W** | **W** | **S** | **S** |
| Course feedback: | Course blog | **S** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **S** |
| | Formal University student feedback process | **W** | **W** | **W** | **W** | **S** | **W** | **W** | **W** | **W** | **W** | **W** | **S** |
| | End of course discussion | **S** | **W** | **W** | **S** | **S** | **M** | **W** | **W** | **W** | **W** | **W** | **S** |
| | Course wiki and. | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Course forum | **W** | **S** | **S** | **S** | **S** | **M** | **M** | **W** | **W** | **W** | **W** | **S** |
| Student academic level: | Freshman level | **S** | **S** | **W** | **S** | **W** | **W** | **W** | **S** | **S** | **S** | **M** | **S** |
| | Sophomore level | **S** | **S** | **W** | **S** | **W** | **W** | **W** | **S** | **S** | **S** | **M** | **S** |
| | Junior level | **S** | **S** | **M** | **S** | **W** | **W** | **W** | **S** | **S** | **S** | **M** | **S** |
| | Senior level | **S** | **S** | **S** | **S** | **M** | **M** | **M** | **S** | **S** | **S** | **M** | **S** |
| | Mixed level: two levels or more | **S** | **M** | **S** | **S** | **M** | **M** | **M** | **S** | **S** | **S** | **M** | **S** |
| Learning resources: | Handouts material | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Text book(s), | **W** | **W** | **S** | **S** | **S** | **S** | **S** | **S** | **W** | **S** | **W** | **W** |
| | Manual book(s), | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **W** | **W** | **W** | **W** |
| | Case studies | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **W** | **W** | **W** | **W** |
| | Learning management system | **W** | **W** | **W** | **W** | **S** | **S** | **S** | **S** | **W** | **W** | **W** | **W** |
| Classroom size and layout: | Over-sized class (>25) | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** |
| | Regular class (20 -25) | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **W** | **S** | **S** |
| | Small class (<20) | **S** | **S** | **M** | **S** | **M** | **M** | **W** | **M** | **W** | **S** | **M** | **S** |
| | One cluster setting | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **W** | **S** | **M** |
| | Small clusters setting | **S** | **S** | **S** | **S** | **S** | **S** | **M** | **S** | **S** | **S** | **W** | **M** |
| Instructor(s) background: | Competent instructor from academia | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** |
| | Group of instructors from academia | **S** | **S** | **M** | **S** | **W** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| | Speakers from industry | **S** | **S** | **S** | **S** | **W** | **S** | **M** | **M** | **M** | **M** | **M** | **W** |
| | Trainers from industry | **S** | **M** | **M** | **S** | **M** | **M** | **M** | **M** | **W** | **S** | **M** | **W** |
| | Instructor from academia with industry experience | **S** | **S** | **S** | **S** | **W** | **S** | **M** | **S** | **S** | **W** | **W** | **W** |

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C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #5

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** | **C10** | **C11** | **C12** |
| Method of course delivery: | Online class | M | S | S | S | S | M | S | M | S | S | M | M |
| | Face-to-face class ( could be hybrid | S | S | W | M | M | M | S | M | S | M | M | S |
| | Integrated in curriculum (or capstone) | M | S | W | S | S | M | M | S | S | S | M | M |
| | Learning contract | W | M | W | M | W | M | M | W | W | M | W | W |
| | Accelerated class | W | W | W | M | M | W | W | W | W | M | W | W |
| The pedagogical approach: | Traditional education | W | W | W | W | W | W | W | W | W | M | W | W |
| | Roll playing/simulation-based learning | S | S | S | M | M | M | M | M | M | - | M | M |
| | Problem/project based learning | S | S | S | S | M | S | S | S | S | S | S | S |
| | Reflection learning | S | S | W | W | - | S | S | S | S | - | S | M |
| | Game-based learning. | M | M | M | S | M | - | W | S | W | - | M | M |
| Course assessment: | Presentations | S | S | - | M | S | S | M | M | M | S | S | M |
| | Portfolios reports | S | S | - | W | - | S | M | M | W | S | W | S |
| | Self-assessment and peer-assessment | S | S | M | - | - | S | M | S | S | M | S | S |
| | Online tools | S | M | - | S | - | S | S | M | M | M | M | M |
| | Assignments, reports and projects | S | M | - | M | M | M | M | M | W | S | W | W |
| Course feedback: | Course blog | S | S | W | - | - | S | S | S | S | - | S | S |
| | Formal University student feedback process | W | W | M | - | - | M | M | M | M | - | M | M |
| | End of course discussion | M | M | - | - | - | M | M | M | M | - | S | M |
| | Course wiki and. | M | S | S | S | - | M | M | M | S | M | M | M |
| | Course forum | S | S | S | M | - | M | M | S | S | M | S | S |
| Student academic level: | Freshman level | M | M | M | M | M | M | M | M | M | M | W | W |
| | Sophomore level | M | M | M | S | M | M | M | M | M | S | M | M |
| | Junior level | M | S | M | S | S | M | M | S | S | S | M | S |
| | Senior level | S | S | S | S | S | S | S | S | S | S | S | S |
| | Mixed level: two levels or more | M | M | M | M | M | M | M | M | M | M | M | M |
| Learning resources: | Handouts material | M | W | W | M | W | W | M | W | W | W | W | W |
| | Text book(s), | M | W | W | M | w | W | w | W | W | w | W | W |
| | Manual book(s), | M | W | W | M | M | W | M | W | W | M | W | W |
| | Case studies | W | W | W | W | W | W | W | W | W | W | W | W |
| | Learning management system | M | S | M | M | W | M | M | S | S | W | S | M |
| Classroom size and layout: | Over-sized class (>25) | W | W | W | W | M | W | W | W | W | W | W | W |
| | Regular class (20 -25) | M | M | W | W | M | M | M | M | M | M | M | M |
| | Small class (<20) | S | S | M | S | M | S | S | S | S | M | S | S |
| | One cluster setting | M | M | W | W | - | M | M | M | W | - | M | M |
| | Small clusters setting | M | M | W | M | - | M | M | M | M | - | M | S |
| Instructor(s) background: | Competent instructor from academia | M | M | - | M | - | M | M | M | M | M | M | M |
| | Group of instructors from academia | S | S | M | M | - | S | M | S | S | M | M | S |
| | Speakers from industry | M | M | M | M | - | M | M | M | M | M | W | W |
| | Trainers from industry | W | W | - | W | - | W | M | W | W | M | W | W |
| | Instructor from academia with industry experience | M | S | M | M | M | S | S | S | S | M | M | M |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #6

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** | **C10** | **C11** | **C12** |
| Method of course delivery: | Online class | | | | | | | | | | | | |
| | Face-to-face class ( could be hybrid | | | s | s | | s | s | s | | | | |
| | Integrated in curriculum (or capstone) | s | s | s | s | s | s | s | s | s | s | s | S |
| | Learning contract | | | | | | | | | | | | |
| | Accelerated class | | | | | | | | | | | | |
| The pedagogical approach: | Traditional education | m | m | s | s | m | s | m | s | m | m | m | m |
| | Roll playing/simulation-based learning | s | s | m | s | s | m | | m | s | m | s | s |
| | Problem/project based learning | | | s | s | | s | s | s | | | | |
| | Reflection learning | s | s | s | | s | s | | s | s | s | s | s |
| | Game-based learning. | | | | | | | | | | | | |
| Course assessment: | Presentations | s | s | s | s | s | s | m | s | s | | s | s |
| | Portfolios reports | | | | | | | | | | | | |
| | Self-assessment and peer-assessment | s | s | | s | s | | | | s | m | s | s |
| | Online tools | | | | | | | | | | | | |
| | Assignments, reports and projects | s | s | | s | s | | | | s | m | s | s |
| Course feedback: | Course blog | | | | | | | | | | | | |
| | Formal University student feedback process | | | | | | | | | | | | |
| | End of course discussion | | | m | m | | m | | m | | s | | |
| | Course wiki and. | | | | | | | | | | | | |
| | Course forum | m | m | | | m | | | | m | m | m | m |
| Student academic level: | Freshman level | | | | | | | | | | | | |
| | Sophomore level | | | | | | | | | | | | |
| | Junior level | | | | | | | | | | | | |
| | Senior level | | | | | | | | | | | | |
| | Mixed level: two levels or more | | | | | | | | | | | | |
| Learning resources: | Handouts material | s | s | s | | s | s | s | s | s | s | s | s |
| | Text book(s), | | | | | | | | | | | | |
| | Manual book(s), | | | | | | | | | | | | |
| | Case studies | | | s | s | | s | | s | | | | |
| | Learning management system | m | m | s | s | m | s | m | s | m | m | m | m |
| Classroom size and layout: | Over-sized class (>25) | | | | | | | | | | | | |
| | Regular class (20 -25) | m | m | m | m | m | m | m | m | m | m | m | m |
| | Small class (<20) | s | s | | m | s | | s | | s | s | s | s |
| | One cluster setting | | | | | | | m | | | | | |
| | Small clusters setting | s | s | | | s | | | | s | s | s | s |
| Instructor(s) background: | Competent instructor from academia | s | s | s | s | s | s | s | s | s | s | s | s |
| | Group of instructors from academia | | | | | | | | | | | | |
| | Speakers from industry | | | | m | | | | | | | | |
| | Trainers from industry | | | | | | | | | | | | |
| | Instructor from academia with industry experience | | | s | s | | s | s | s | | | | |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## The Structured Interview Matrix Rated By Respondent #7

| Issue | | Soft Skills Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The curriculum domains** | **The curriculum domain alternatives** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** | **C10** | **C11** | **C12** |
| Method of course delivery: | Online class | | | | | | | | | | | | |
| | Face-to-face class ( could be hybrid | | | | | | | s | | | | | |
| | Integrated in curriculum (or capstone) | s | s | | s | | | | | s | s | | s |
| | Learning contract | | | | | | | | s | | | | |
| | Accelerated class | s | s | | s | | | | | | | | |
| The pedagogical approach: | Traditional education | | s | | | | s | | | | s | | |
| | Roll playing/simulation-based learning | | s | | s | | s | s | | s | | s | s |
| | Problem/project based learning | | | s | s | | s | s | | | | | |
| | Reflection learning | s | s | | s | | s | s | | s | | s | |
| | Game-based learning. | | | | | | | | | | | | |
| Course assessment: | Presentations | s | | | | s | | | | | | | s |
| | Portfolios reports | | | | | s | | | | | | s | |
| | Self-assessment and peer-assessment | s | | | s | | | s | | s | | | |
| | Online tools | | | | | | | | | | | | |
| | Assignments, reports and projects | | | | | s | | | | | | | |
| Course feedback: | Course blog | | | | s | | | | | | | | |
| | Formal University student feedback process | | | | | | | s | s | | | s | |
| | End of course discussion | s | | s | | | | | | | | | s |
| | Course wiki and. | | | | | | | | | | | | |
| | Course forum | s | s | | | | s | | | | | s | s |
| Student academic level: | Freshman level | | | | | | | | | | | | |
| | Sophomore level | | | | | | | | | | | | |
| | Junior level | | | | | | | | | | | | |
| | Senior level | | | | | | | | | | | | |
| | Mixed level: two levels or more | | | | | | | | | | | | |
| Learning resources: | Handouts material | | | | | | | | | | | | |
| | Text book(s), | | | | | | | | | | | | |
| | Manual book(s), | | | | | | | | | | | | |
| | Case studies | s | | | | | s | s | | s | | | s |
| | Learning management system | | | | | | | | | | | | |
| Classroom size and layout: | Over-sized class (>25) | | | | | | | | | | | | |
| | Regular class (20 -25) | s | | | | | | | | | | | |
| | Small class (<20) | | | | | | | | | | | | |
| | One cluster setting | | | | | | | | | | | | |
| | Small clusters setting | | | | | | | | | | | | |
| Instructor(s) background: | Competent instructor from academia | | | | | | | | | | | | |
| | Group of instructors from academia | | | | s | | | | | | | | |
| | Speakers from industry | s | s | | | | | | | | | | |
| | Trainers from industry | | | | | | | | | | | | |
| | Instructor from academia with industry experience | | | | | | | s | | | | | |

Values are based on a scale and acronym where 1 = (W: "Weak relationship"), 3 = (M: "Medium relationship"), 7 = (S: "Strong Relationship"), and 0 = (Blank: "No relationship or can't determine").

C1: Cluster #1: Communication skills
C2: Cluster #2: Workplace thinking skills
C3: Cluster #3: Conflict resolution and negotiation skills
C4: Cluster #4: Teamwork and collaboration skills
C5: Cluster #5: Stress-management skills
C6: Cluster #6: Workplace professionalism skills,
C7: Cluster #7: Workplace productivity skills
C8: Cluster #8: Workplace ethics skills
C9:Cluster #9: Workplace diversity skills
C10: Cluster #10: Planning and organizing skills
C11:Cluster #11: Self intelligence skills
C12:Cluster #12: Social intelligence skills

## Appendix ‘E’: Calculating the Six Sigma Level

As previously discussed in Chapter 3, the research utilized Six Sigma quality approach over TQM for its ability to offer more discipline quality which can be achieved by the structured framework and the ability to set measurable future development goals. Calculating the Six Sigma level for the 12 soft skills clusters aims at defining the soft skills gap magnitude. The soft skills gap magnitude will be used in the future as a development indicator.

The six sigma level is defined as "*The objective of 3.4 defects per million opportunities*" (DPMO) (Pyzdek and Keller 2014). The six sigma formulas that were used to accomplish this task were adopted from: The Six Sigma Handbook by Pyzdek and Keller (2014) and Implementing Six Sigma: smarter solutions using statistical methods by Breyfogle III (2003). Also, an online Six Sigma calculator (http://world-class-manufacturing.com) was used in the last calculation step.

Calculation steps were as follows:

1. The maximum value for Sigma Level = 6
2. For each cluster the percentage of satisfaction to the importance (***S/I)*** was calculated
3. The defects **D** for each cluster was calculated using the formula ***D = 1 - (S/I)***
4. Defects Per Million Opportunities **DPMO** was calculated using the formula ***DPMO= D x 1000000***
5. Finally, an online calculator (http://world-class – mnufactureing.com) was used to calculate Sigma Level from the **DPMO** value

Table E.1 summarizes the Sigma Level calculation for the 12 soft skills clusters and for the overall soft skills.

Table E.1: The gap score calculations

| Code | Cluster | Satisfaction Mean | Importance Mean | S/I | D | DPMO | Sigma Level (SL) |
|---|---|---|---|---|---|---|---|
| C1 | Communication skills | 3.2255 | 4.4771 | 0.7204 | 0.2796 | 279556 | **2.08** |
| C2 | Workplace thinking skills | 3.3366 | 4.4477 | 0.7502 | 0.2498 | 249815 | **2.18** |
| C3 | Conflict resolution and negotiation skills | 2.8693 | 4.1405 | 0.6930 | 0.3070 | 307016 | **2.00** |
| C4 | Teamwork and collaboration skills | 3.3007 | 4.1536 | 0.7947 | 0.2053 | 205340 | **2.32** |
| C5 | Stress-management skills | 3.0588 | 4.0850 | 0.7488 | 0.2512 | 251212 | **2.17** |
| C6 | Workplace professionalism skills | 3.2190 | 4.1209 | 0.7811 | 0.2189 | 218860 | **2.28** |
| C7 | Workplace productivity skills | 3.2451 | 4.0294 | 0.8054 | 0.1946 | 194644 | **2.36** |
| C8 | Workplace ethics skills | 3.4444 | 4.3987 | 0.7830 | 0.2170 | 216950 | **2.28** |
| C9 | Workplace diversity skills | 3.3791 | 3.6209 | 0.9332 | 0.0668 | 66779 | **3.00** |
| C10 | Planning and organizing skills | 3.2647 | 4.2484 | 0.7685 | 0.2315 | 231546 | **2.23** |
| C11 | Self-intelligence skills | 3.2876 | 3.9771 | 0.8266 | 0.1734 | 173368 | **2.44** |
| C12 | Social intelligence skills | 3.1209 | 3.9510 | 0.7899 | 0.2101 | 210099 | **2.31** |
| Av. | Average 12 clusters | | | | | | **2.30** |
| OA | Overall soft skills | 3.2059 | 4.1765 | 0.7676 | 0.2324 | 232400 | **2.23** |

The results show that all 12 soft skills clusters have a noncompetitive Sigma Level. The Sigma Level values ranged between **2.00 Sigma** and **3.00 Sigma**. The highest Sigma Level value exists in "*Cluster #9: Workplace diversity skills.*" The lowest Sigma Level value exists in "*Cluster #3: Conflict resolution and negotiation skills*." The Sigma Level value for the Overall (OA) 12 clusters is **2.23 Sigma,** while the average Sigma Level value for the Average (Av.) 12 clusters is **2.30 Sigma**.

These results also triangulated the Gap Score Analysis and Quadrant Analysis results (Chapter 5), whereas critical performance defects among construction graduates are in "*Cluster #9: Conflict resolution and negotiation skills*" and "*Cluster #1: Communication skills.*"

**Appendix ‘F’: The Experts Feedback**

**Feedback Expert #1**

- Do you think that applying the study results in construction education can help in reducing the soft skills gap?

  **Yes**

- Do you think that the proposed 4 Curriculum Models can help educators in implementing soft skills in construction education?
  a. Is it useful? **See question 2c**
  b. Is it applicable? **Yes.**
  c. Is it easy to understand? **Not so easy to understand. I understand the quadrant analysis, and the QFD Matrix, but I am a little unclear on the models. Why are only two clusters (C1 and C3) included in Table 2? And how does that data transfer to the models?**
- Comment on the quality of the theoretical framework as a design aid framework?

  **The course delivery, pedagogical approach, course assessment technique, feedback model, learning resources would help with design of a course.**
- Do you think that there is any missing component from the Decision Aid framework? Or from the study?

  **None that I can think of.**
- What are your suggestions to improve the study?

  **It appears that the study was done well, I would simply suggest a little more explanation to connect the key pieces together more tightly.**
- What are your recommendations for future research?

  **Testing recommendations in construction classroom to determine if soft skills increase as a result.**
- Final thoughts?

  **Good luck!**

**Feedback Expert #2**

- Do you think that applying the study results in construction education can help in reducing the soft skills gap?

  **Yes**

- Do you think that the proposed 4 Curriculum Models can help educators in implementing soft skills in construction education?
  a. Is it useful? **Yes**
  b. Is it applicable? **Yes**
  c. Is it easy to understand? **Yes**
- Comment on the quality of the theoritical framework as a design aid framework?

  **It is very useful and can be implemented easily**

- Do you think that there is any missing component from the Decision Aid framework? Or from the study?

  **No**

- What are your suggestions to improve the study?

  **If there are some suggested topics that cover each skill**

- What are your recommendations for future research?

  **NA**

- Final thoughts?

  **I think it is an excellent research**

**Feedback Expert #3**

- Do you think that applying the study results in construction education can help in reducing the soft skills gap?
  - **The research outcomes can reduce the soft skills gaps for construction graduates**
- Do you think that the proposed 4 Curriculum Models can help educators in implementing soft skills in construction education?
  a. Is it useful?

     **Yes, it will be an excellent model for construction education.**

  b. Is it applicable?

     **Yes, however, it is very important to have an excellent instructor who can fully implement the suggested approaches.**

  c. Is it easy to understand?

     **It makes sense.**
- Comment on the quality of the theoretical framework as a design aid framework?

  **It is a good quality work.**
- Do you think that there is any missing component from the Decision Aid framework? Or from the study?
  - **It is better to collect survey data from construction students, educators, and construction participants.**
  - **It is better to have clear supporting materials (foundation) for selecting the curriculum domain alternatives.**
  -
- What are your suggestions to improve the study?

  **NA**
- What are your recommendations for future research?

  **It will be good to compare the construction graduate's soft skill level between students with current education curriculum and your suggested education curriculum.**

  **I think you need to think about the budgetary issues with your curriculum model since everyone knows that small class/small class setting are good for students but it is not easy to educate students with small class.**

**It will be good to cluster the applicable course names with your approach (optimal or realistic approach) for current construction students with limited funding, instructors, and resources.**

- Final thoughts?

  **You did a great job!!!**

**Feedback Expert #4**

- Do you think that applying the study results in construction education can help in reducing the soft skills gap?

  **Yes over time as long as it is broadly applied in education – tertiary sector as well as trades.**

- Do you think that the proposed 4 Curriculum Models can help educators in implementing soft skills in construction education?

  a. Is it useful?

     **Yes very. It provides a useful framework to either implement in whole or part or adapt to specific country/educational environments**

  b. Is it applicable?

     **Yes I believe it is not only applicable but comprehensive in terms of the types of skills and attributes that are being required or are seen as optimal in Construction Management career fields. However, I do not think it is unique. These attributes also apply to general management careers as well.**

  c. Is it easy to understand?

     **Yes I believe it is very easy to understand – the only thing I didn't quite understand was the "Priority" setting section. Not sure I understand why you would give priority to certain sets of skills – the priorities are fairly perspective driven and arguably all are of equal importance or could be at different times in a management role.**

- Comment on the quality of the theoretical framework as a design aid framework?

  **I think the Model/Models are an excellent framework as a design aid to units and courses of study in soft skills.**

- Do you think that there is any missing component from the Decision Aid framework? Or from the study?

  **I think the addition of Learning Outcomes for each skill cluster would be very useful as this often drives the design of assessment and teaching.**
  **Not sure I agree with self- assessment and peer assessment as the only means of assessment.**

**I think you could probably use Role playing/simulation-based learning in all four model areas.**

**I like the idea of integration into the whole curriculum and/or a capstone. Here at the University of Canberra we are "trialing" an introductory (first year) unit on Professionalism etc. so the question is "is it better to raise these skills with them early on in their education or later once they almost completed their study and have perhaps more understanding of its importance and impact on their careers?"**

- What are your suggestions to improve the study?

  **I think that I would leave out the Quadrant Analysis or priority setting section – you could replace this with a discussion about the relative importance of different factors in different environmental, social and international settings. For example, there will be specific situations where Workplace Diversity is hugely important. To me they are all equally important. Here in Australia we would place a lot of emphasis on Workplace Ethics and Teamwork skills, but not put this above Communication, Planning and Productivity.**

  **Is Problem solving included in one of the clusters? If not I think it should be. Much of a construction manager'**

- What are your recommendations for future research?

  **You could measure your entry level students' soft skills levels and then test them again following the completion of their courses to see what improvement/change the whole course has made.**

- Final thoughts?

  **I like this work. It is much needed in the construction industry. I cannot imagine how you might make the unequivocal link, but I believe that education in soft skills has the potential to improve construction industry productivity through reduction in disputation, improved communication, and greater teamwork. For years "partnering" has been advocated as the new model to improve construction productivity but changing the model of**

**procurement/contractor engagement alone has not reaped the promised benefits. Soft skills may be the key or at least one of them.**