

Rethinking Construction Curriculum: Towards a Standard Soft Skills Taxonomy

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The construction industry demands people who are equipped with a high level of soft skills to increase the efficiency of work, processes, and technology. Existing content, definition, interpretations and approaches for soft skills used among construction stakeholders are not clear. This challenge contributes to a soft skills gap among construction graduates and hinders them from possessing the expected minimum soft skills level. The purpose of this paper is to propose a novel construction-related soft skills' taxonomy. A literature-based discovery method is applied for 32 scholarly documents. Soft skills are extracted, reduced, classified and organized into 12 clusters that constitute the taxonomy. The classification decisions are based on the hidden knowledge across the documents, the experiential knowledge of the authors, and are further triangulated utilizing a survey with feedback from industry and several interviews with academia. The proposed taxonomy is used further to develop a theoretical framework intended to help academia to better integrate a soft skills in construction curricula. It is suggested that this taxonomy would pave the road towards a soft skills' standardization in future studies.

Key Words: Construction, Curriculum, Soft Skills, Taxonomy, Literature-based Discovery, KJ Method

Introduction

The existence of a soft skills gap among construction schools graduates was previously discussed by the authors (Mahasneh & Thabet, 2015). The work presented their understanding for the soft skills in general and analyzed the soft skills gap among the construction graduates. The study imputed the problem to five causes that in combination or isolation contribute to the continued existence of the soft skills gap. The first one is the absence of clear soft skills definition, content and interpretations among construction educators and employers. The other causes are the absence of quantitative data that helps in better understanding to the problem, the absence of structured remedies or solutions, the difficulties of providing the needed soft skills within the traditional undergraduate curricula and accreditation standards.

These findings are used for proposing criteria to evaluate and determine the theoretical framework to implement soft skills in construction education. Three case studies that represent good methodologies for solving similar problems across different discipline have been identified. A normative analysis was conducted to the case studies; this analysis resulted in identifying design for six sigma quality framework to be utilized as a theoretical framework for the research.

The proposed theoretical framework is comprised of five phases: Define Phase, Measure Phase, Analyze Phase, Design Phase and Verify Phase (DMADV). Table (1) summarized the objectives of each phase.

Table 1: Summary for the theoretical decision aid framework tasks

Phase	Tasks
Define:	<ul style="list-style-type: none"> ▪ Define the construction-related soft skills ▪ Define the best practices in teaching soft skills
Measure:	<ul style="list-style-type: none"> ▪ Measure the level of soft skills among the construction graduates in entry-level positions ▪ Measure the relationships weight between each soft skills cluster and each curriculum domain alternative.

Analyze:	<ul style="list-style-type: none"> ▪ Benchmark the existing state of the 12 soft skills clusters among construction graduates. ▪ Measure the relationship between the soft skills taxonomy and the list of existing instructional strategies
Design:	<ul style="list-style-type: none"> ▪ Draw up the soft skills curriculum models. The model includes the soft skills content, priority and the best alternative for each domain. ▪ Develop a narrative description that reflects the authors understanding for the results.
Verify:	<ul style="list-style-type: none"> ▪ Calculate the soft skills clusters gap score and add them to the proposed curriculum. ▪ Share the results with experts in soft skills education to verify the quality and the visibility of the results

This paper presents the steps needed to achieve the Define Phase. It is hypothesized that organizing the soft skills using a standard taxonomy (a scheme of classification) will provide a tool for benchmarking the soft skills level among construction graduates. The following section summarizes the authors' perspective to develop and propose the soft skills taxonomy using the Literature-based Discovery method complemented with the KJ method.

The Method

An iterative structured approach was developed by adopting the Literature-Based Discovery (LBD) method and KJ Method (sometimes referred to as affinity diagrams). The LBD method is a method that uses scholarly documents in order to define new relationships among existing knowledge, and produce trustworthy results (Ganiz, Pottenger, & Janneck, 2005; Mahasneh & Thabet, 2015). The KJ method is a decision-making and problem-solving 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 as a tool to support the LDB method.

The proposed iterative structured approach is comprised of five major steps: Evaluate and define the source of knowledge, extract soft skills from the literature documents, data reduction, data grouping, and taxonomy reliability and validity. The following is description of these steps.

Step 1: Evaluate and define the source of knowledge:

Google Scholar was used to conduct a random search for the terminologies: soft skills, non-technical skills, employability skills, competences, leadership, emotional intelligence, and other construction related skills. After a long process of filtration, 32 scholarly documents were identified. The documents had a high relevancy to soft skills domain like competencies, employability, leadership, emotional intelligence, etc. Also, it addressed multidimensional perspective examples of good practices in the domain. The source of the documents included:

1. The bachelor degree accreditation standards for American Council for Construction Education (ACCE) and Accreditation Board for Engineering and Technology (ABET).
2. The United States governmental standards/ reports documents.
3. The international standards/ reports documents: Cases from European, Union Australia, and Canada.
4. The construction related scholarly publication documents.
5. 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.

The 32 documents were classified, coded, and listed as shown in Table 1.

Table 1: The 32 documents that were used in defining soft skills

#	Document Title and Citation
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, Berryman, Goslin, & Meltzer, 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, Flynn, Thomasson, Alexander, & McDonald, 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 & Robson, 2013).
 14. Key Competencies For U.S. Construction Graduates: Industry Perspective (Ahn, Annie, & Kwon, 2012)
 15. Notice of Retraction Soft skills implementation in construction management program: A survey of Malaysian public universities (H. M. Affandi, F. Hassan, Z. Ismail, & M. F. M. Kamal, 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, Jang, Park, & Choi, 2014).
 19. Developing project management competency: perspectives from the construction industry (Edum-Fotwe & McCaffer, 2000).
 20. Projects and personalities: A framework for individualizing project management career development in the construction industry (Madter, Bower, & Aritua, 2012).
 21. Evaluation Of Graduate Learning Outcomes Using Constructive Alignment in Australia (Mills & McLaughlin).
 22. Primal Leadership: Learning to Lead with Emotional Intelligence (Golemon, Boyatzis, & McKee, 2004).
 23. Leadership Education and Training "Leadership Skills Truly Make a Difference"(Badger, Wiesel, & Bopp, 2007)
 24. Embedding Leadership Development in Construction Engineering and Management Education (Riley, Horman, & Messner, 2008).
 25. Learning the soft skills of leadership (Crosbie, 2005)
 26. Soft skills and dental education (Gonzalez, Abu Kasim, & Naimie, 2013).
 27. Concrete Steps for Assessing the "Soft Skills" in an MBA Program (Ingols & Shapiro, 2014).
 28. Soft Skills for TQM in Higher Education Standards (van Kemenade, 2012).
 29. Accommodating Soft Skills in Software Project Management (Sukhoo, Barnard, Eloff, Van der Poll, & Motah, 2005).
 30. Soft And Hard Skills Development: A Current Situation In Serbian Companies (Babić & Slavković, 2011).
 31. Teaching Soft Skills Employers Need (Ellis, Kisling, & Hackworth, 2014).
 32. Civil engineering body of knowledge for the 21st century: Preparing the civil engineer for the future (Committee, 2004).
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Step 2: Extract soft skills from the literature documents:

In this study, the soft skills terminology was defined as "the needed ability and traits that are often used to describe the non-technical skills" (Mahasneh & Thabet, 2015). This definition was used as a unit of recording to extract all soft skills from the (32) documents. Each word, a group of words, a sentence, or group of sentences "the context" which corresponds to that prior definition were recorded. All soft skills were considered equally important. Many of the soft skills overlapped and interlocked. This means that some aspects in a soft skill are essential and/or support another soft skill. However, the authors documented them exactly as they were found in the documents. This step resulted in identifying 497 skills.

Step 3: Data reduction:

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

- Filter #1: Remove repetition for the soft skill repeated more than once.
- Filter #2: Normalize the 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.

This step resulted in reducing the skills from 497 to 120 skills as denoted in Table 3.

Table 3 : Soft Skill List after data reduction

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: Data grouping:

The KJ method (Affinity diagram) was used to group the soft skills into 12 clusters. The use of the KJ method makes the skills visually controlled and immediately accessible. The rationality of organizing the relevant soft skills into 12 clusters removed some of the subjectivity surrounding a single skill.

Each soft skill from the inventory list was written into sticky-notes as shown in Figure (1) The sticky-notes were sorted by placing the relevant soft skills into relevant groups as shown in Figure (2). The grouping decision was based on the existing knowledge and the researchers' understanding gained from the 32 literature documents reviewed.



Figure 1: Writing the skills in sticky notes

For each group, a title card or a word was chosen that best describes all soft skills in that group. Finally, the 12 clusters were documented in a form of clusters (title) and sub-clusters (soft skills).

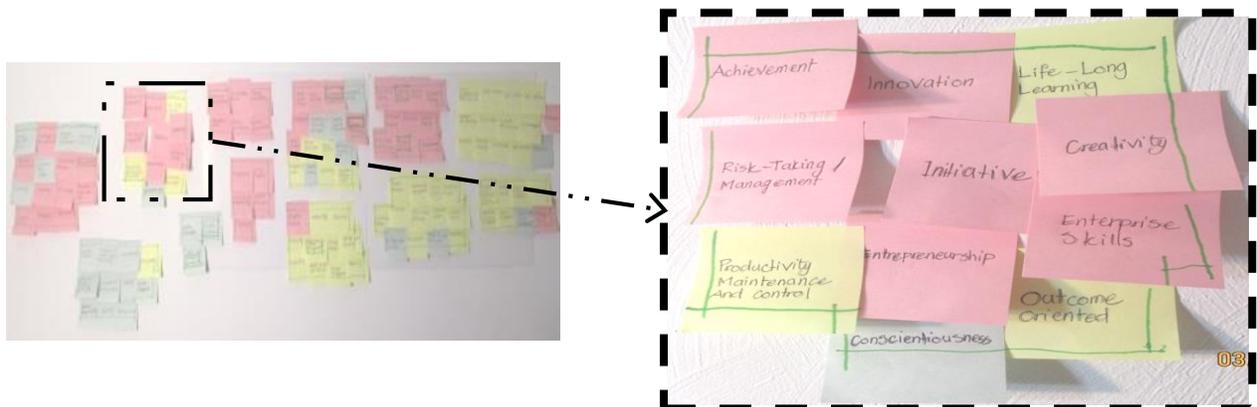


Figure 2: The soft skills grouping

As an example, Table (4) summarizes the clustering decision for the communication skills:

Table 4: The knowledge discovery for communication skills cluster

Cluster #1: Communication Skills

Definition: It was determined to group the skills that are related to communication in one cluster. A simple definition was developed by the authors as guidance: “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.” All sticky-notes that fit under that definition were sorted and grouped together.

Discovery: The 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, and 32) were found to include the aspect of this cluster in a unique category of their definition and/ or framework. Three documents (3, 7, and 21) grouped reading, listening, speaking and writing skills together in one category.

- Ten documents (1, 2, 3, 5, 7, 11, 14, 16, 21, and 24) were used as evidence to classify speaking in this cluster.
- Nine documents (1, 2, 3, 7, 11, 14, 16, 21, and 24) were used as evidence to classify writing in this cluster.
- Four documents (3, 5, 7, and 21) were used as evidence to classify listening in this cluster.
- Three documents (3, 7, and 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 Name: Listening communication, presentation skills, reading communication, speaking communication, writing communication.

Step 5: Taxonomy reliability and validity:

To check the grouping reliability, the categorization process was repeated after nine months from the first attempt. The results were compared to the initial categorization and were found identical.

Results were also shared with professionals in the industry and experts from academia. The defined soft skills taxonomy clusters were shared with the construction academia a part of a pilot study. The authors also engaged with several academic experts in open discussion. Feedback was collected and minor changes to the clusters were made.

Also, the taxonomy was used in three surveys that targeted the construction industry professionals. The total number of the respondents in the three surveys was 323 respondents. In one of the surveys, the respondents were asked to accept the taxonomy or refuse it. Out of 260 respondents, 242 answered with yes they accept the 12 clusters and the other suggest some modifications. In the other two surveys, 7 respondents out of 60 suggested modifications to the soft skills cluster. This means that 93.5% from the industry professions accept the taxonomy.

Given the previous effort, it was concluded that would be the needed evidence of validity and reliability for the taxonomy to be used in future work.

Results

Both industry and academia respondents did not communicate any major changes to the taxonomy clusters. Suggestions were given to add a few skills to the taxonomy. Based on the findings, the soft skills taxonomy was updated. Table (3) denotes the proposed soft skills taxonomy after the latest update:

Table 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

Discussion

The paper demonstrated the utilization of a Literature-Based Discovery approach for developing and proposing a novel soft skills' taxonomy. The paper 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 lacked in the 32 scholarly documents reviewed.

The proposed taxonomy was used in the implementation of a theoretical framework intended to benchmark the soft skills gap among entry-level construction graduates. The development of the framework also involves at developing and proposing soft skills instructional curriculum models. Given the acceptable amount of reliability and validity achieved through triangulation, the authors anticipate that the proposed taxonomy could be helpful to other scholars in their work related to the soft skills domain. 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 evaluate and capture soft skills knowledge. Second it could explicate a standard soft skills content, definition, interpretations and approaches in order to more effectively transfer knowledge to construction students.

Future work by the authors intends to define the interrelationship among the 12 soft skills clusters.

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