Measuring the Knowledge, Skills, and Abilities of Safety and Health Professionals

Jarred O'Dell

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MEASURING THE KNOWLEDGE, SKILLS, AND ABILITIES OF SAFETY AND HEALTH PROFESSIONALS

A Thesis
Submitted to the School of Graduate Studies and Research
in Partial Fulfillment of the
Requirements for the Degree
Master of Science

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May 2017
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The purpose of this study was to map the competencies of the safety professional at various stages of career progression. The researcher identified competencies as being made up of three core areas known as: Knowledge, Skills, and Abilities (KSA). Additionally, the researcher identified career stages as begin broken into three general categories herein identified as: Entry-Level, Mid-Level, and Senior-Level.

After defining some general guidelines for the KSA competencies, the researcher conducted a survey asking safety professionals located primarily in the Northeastern United States to rate a series of competencies for each stage of career progression. It is the intent of the researcher to use much of the data that was collected as a primer for future research as well as a reconnoiter to shape the general direction of that research. The researcher also included several demographic benchmarks into the survey as an effort to determine if there was any bias in the data that was collected.

From there, the researcher examined the sub-set of the skill competencies identified as applied skills; that is, skills that are specifically related to the safety professional’s job description, and are less likely to be transferable. There, the researcher reported that regardless of career stage, safety professionals rated 1) Risk Assessment / Hazard Identification, and 2) Knowledge of Accident Investigation / Incident Analysis skills higher than the other applied skills.
ACKNOWLEDGMENTS

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I also want to thank my colleagues, fellow students, and the others that participated in my pilot study and survey. I was truly humbled by the influx of emails offering support, encouragement, and well wishes. Without them, this research could not have taken place.

Most importantly, I wish to extend my special thanks to my wife, Susan, and my two sons, Will and Alex. It was their countless hours of sacrifice that allowed me to work towards my academic pursuits. Lastly, I would like to thank LTC Mark Spitler and his wife Mrs. Betsy Spitler; who at a young age shaped me and set me my course to adulthood.
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CHAPTER 1

INTRODUCTION

BACKGROUND

In the United States, a diverse group of over 110,000 safety and health specialists, technicians, and engineers (BLS, 2014), employing a wide range of competencies, are engaged in preventing and lessening the impact of injury and illness on the American workforce. The industries they serve range from: Manufacturing, to oil and gas extraction, to construction, to insurance carriers, and many others (BLS, 2014). The Safety, Health and Environmental (SH&E) Industry: 2015 salary survey found the median age of the working safety and health professional to be 50 years; whereas, the median number of years as a safety and health professional was only 19 (Readex Research, 2015). This would indicate that the many safety and health professionals currently in the workforce brought work experience with them from outside the safety and health profession.

Similarly, a study conducted on behalf of the National Institute of Occupational Safety and Health (NIOSH) has indicated that Occupational Safety and Health degree programs are not producing safety and health specialists, technicians, and engineers at the rate of industry growth (McAdams, Kerwin, Olivo, & Goksel, 2011). Therefore, both historical data and industry forecasts suggest that a significant population of safety and health professionals have come, and will continue to be imported, from other trades and professions.

From a practical standpoint, both human resource professionals attempting to fill vacant safety positions, and the emerging safety professionals, that is, those coming from other trades and professions in hopes of filling these vacancies, would greatly benefit from having a baseline set of competencies for measuring the needs of the vacant position against the competencies of the
applicant. To a degree, the human resource profession has developed a framework for doing this. Namely, the human resource profession has developed a concept of competencies (Noe, Hollenbeck, Gerhart, & Wright, 2011; Bonder, Bouchard, & Bellemare, 2011). However, the human resource profession has been criticized for poorly defining, and not consistently applying competency requirements (Kuhn, 2015; Ngah, 2016).

Significance of the Problem

As safety and health staffing continues to increase to meet the needs of industry, the emphasis on identifying the core competencies of safety and health professionals will likely increase as well. Fortunately, the National Assessment of the Occupational Safety and Health Workforce (NASHW) prepared for NIOSH did indicate these core competencies (McAdams, et al., 2011). However, this assessment was limited to entry level core competencies of the safety and health profession. With the median age of the safety and health professional at 50 (Readex Research, 2015), and the median age of the U.S. labor force at 41.9 (BLS, 2015), it is reasonable to conclude that retirement will result in the need for advancement across all levels of the safety and health profession, not just entry level positions, sooner than the mainstream U.S. workforce. Therefore, the need to identify the core competencies of safety and health professionals at entry-level, mid-level, senior-level positions will be of great value to those in the safety and health profession, the human resource groups attempting to staff vacancies, and emerging safety professionals attempting to gain entry into the safety and health profession.
Research Question

The purpose of this research was to map the core competencies (knowledge, skills, and abilities) of safety and health professionals at the entry-level, mid-level, and senior-level stages of career progression. To facilitate, this research devised and conducted a survey as prescribed in chapter three of this paper. This research set its sights on answering the following research question:

RQ: Did the respondents agree on a consistent set of specialized competencies for every career stage?

Hypotheses

To articulate further, the following hypotheses was developed in association to RQ:

\( H_0: \) There are no significant differences among the respondents’ perceived mean rating for a specific skill for a specific level of the safety and health professional’s career development.

\( H_1: \) There are significant differences among the respondents’ perceived mean rating for a specific skill for a specific level of the safety and health professional’s career development.

These tested hypotheses are generic ones that apply to the 13 applied skills studied across the three levels, which will generate a total of 39 possible combinations.
Abbreviated Terms

**ASSE** – American Society of Safety Engineers

**BLS** – Bureau of Labor Statistics

**BOK** – Body of Knowledge. The ASSE’s online repository of “high-caliber vetted knowledge for the SH&E profession” (ASSE, n.d.).

**EHS** – Environmental Health and Safety

**HR** – Human Resources

**NASHW** – National Assessment of the Occupational Safety and Health Workforce

**NIOSH** – National Institute of Occupational Safety and Health

**OSHA** – Occupational Safety and Health Administration

**OS&H** – Occupational Safety and Health

**S&H** – Safety and Health

**SH&E** – Safety, Health and Environmental

**Definition of Terms**

**Abilities** – Abilities are those attributes associated with one’s physical ability to perform a physical task (DeSimone, & Werner, 2012). For instance, a worker may be required to have the ability to stand and walk. In addition, the worker may be required to lift fifty pounds. Alternatively, there are characteristics that may eliminate a worker’s eligibility to perform a given task; colorblindness is one example.

**Applied Skills** – Applied skills, along with general skills, comprise the two fundamental groupings of the skills competency. Applied skills are those that specifically relate to the job description, and are less likely to be transferable than general skills. For instance, the applied skills associated with accident investigation may be considered unique to the safety
and health profession; whereas, the general skills associated with public speaking can be applied virtually anywhere.

*Behavior Skills* – The heart of behavior skills can be seen in the interactions between two people. In a group setting, this category ranges from the ability to communicate, to being able to work in teams and work collaboratively. On a more one-on-one level, this grouping includes interpersonal skills and diversity sensitivity.

*Credentials* – Lastly, the number of credentials held was also considered. For the purposes of this research, a list of safety and health related credentials was compiled. Those surveyed would check boxes indicating what predetermined credential(s) he or she held.

*Competencies* – For the purposes of this research, competencies shall be the term used to encompass the aspects of knowledge, skills and abilities (KSA) as they relate to measuring the needs of a vacant job opening against the KSA of the potential applicant for organizational staffing purposes (Noe, et al., 2011; Bonder, et al., 2011).

*Education* – For this facet, education will be measured in two ways. First, the highest level of education, in terms of degree conferred, will be identified. Secondly, the relatedness of the degree will be identified. For instance, a degree in occupational safety will carry more weight than a degree in business. To facilitate, this research applied the weighting scale developed by the Board of Certified Safety Professionals (BCSP) used for evaluating applicants for the Associate Safety Professional (ASP) and Certified Safety Professional (CSP) credentials.

*Emerging safety professional* – For the purpose of this research, a tradesmen or professional that has established him or herself in a craft or profession outside of safety and has begun transitioning into the safety profession.
General Skills – General skills, along with applied skills, comprise the two fundamental groupings of the skills competency. General skills can be broken down further into the subgroupings of hard skills, and soft skills.

Knowledge – For this application, knowledge can be defined as “factual or procedural information that is necessary for successfully performing a task” (Noe, et al., 2011). For the purpose of this research, knowledge was measured in three ways: 1) Education, 2) Training, and 3) Credentials.

Safety Professional – One who spends the majority (≥51%) of his or her time engaged in safety and health activities in the interest of his or her employer. Such activities may include, but are not limited to, injury and illness trending, safety training / education, safety and health management, and other efforts that reduce or lessen the potential for injury or illness.

Safety Professional – Novice: These safety professionals (SP) may have vast experience in other areas outside of safety, but limited time in the safety profession. These SPs are still in need of training and close supervision to hone skills. These SPs may engage in networking with friends, family, classmates, coworkers, and others.

Safety Professional – Mid-level: These SPs tend to have the authority to work independently or with little supervision. They may be tasked to implement programs and policies with senior approval. At this stage of their career, these SPs tend to lean away from social networking in favor of professional networking. SPs at this level may be content to stay at this level of responsibility indefinitely. This may be due to a preference for remaining active in the safety profession is lieu of taking on a more conventional role as supervising manager.

Safety Professional – Senior: SPs at this level may supervise many mid-level and entry level SPs. SPs at this level tend to be responsible for setting department and organizational goals and
policy. These SPs make it a point to attend training for the purpose of maintaining skills rather than learning new skills. Alternatively, these SPs may be sought after for their knowledge and expertise in a particular subject or subjects. These SPs may work alone or collaboratively in groups. These SPs will have an extensive network of colleagues in a variety of professions.

**Skills** – For the purposes of this research, skills were broken into three groupings. Alphabetically, these groupings were titled: Behavior skills, Hard skills, and Soft skills (DeSimone, et al., 2012). A description of each can be found in the sections that follow.

**Training** – Here, only structured safety and health related training resulting in a course completion certificate or certification was considered; and the total volume of hours calculated. Informal training was not considered for the purposes of this research. To illustrate, an OSHA 30-hour construction course, and a HAZWOPER 40-hour course for a combined total of 70 hours of training would be considered as each resulted in a course completion card, or certification. Alternatively, attending a 30 minute safety meeting on a weekly basis would not be eligible for the purposes of this research. The rationale behind this restriction is twofold. First, the goal is to elicit an accurate estimation of training hours by eliminating the need for speculation. Second, this also limits training to that conducted by a more professional class of instructor as in many of these instances the trainer will have been required to demonstrate in some way his or her ability to teach.

**Hard Skills** – Hard skills are skills that can be learned and are more easily measured than those found in the other two categories. Some examples include proficiency in: Math, science, and physics. Although less straightforward, this grouping also includes: Computer interfacing, typing, and proficiency in a foreign language.
Soft Skills – Although soft skills can be learned, they tend to be seen more as who a person is. These skills can be broken into two sub-categories: Internal and external. The internal side of this skill set includes the abilities to persuade, motivate, and be patient. The external side includes: Planning, organization, adaptability, problem solving, and time management.

Assumptions

First, it was assumed that the survey respondents are versed in the competencies of the safety and health profession, having both experience in the profession and some degree of formal education and training; as such, a respondent would have an authoritative view of the challenges facing the safety and health industry, and not simply that of their organization. Secondly, the honesty and rightfulness of the responses provided by participants was assumed to be genuine.

Limitations

There were five major limitations of this research that need to be addressed. First, this research was limited to the field of those identifying themselves as safety professionals; thus, those better identified as industrial hygienists, occupational medical professionals, and other similar occupations, fell outside of the scope of this research. Second, additional sets of competencies unique to each distinctive industry (e.g. manufacturing, construction, etc.) may also exist; thus, the survey results may reflect only the industries represented in the survey population. Third, this study did not take into account the size of the participant’s organization. Fourth, this study did not identify how many safety professionals work at the participant’s organization; nor, did it account for multiple safety professionals from a single organization participating in this study. Lastly, this survey was only made available in English; thus, non-English speakers, who may or may not represent a significant population in the United States, would not be represented.
Delimitations

There were two delimitations to this study that should be noted. The study sample was purposefully designed to include all full-time working Safety Professionals regardless of industry. Secondly, this study focused on Safety Professionals centered in the northeastern United States.
CHAPTER 2
LITERATURE REVIEW

Introduction

The purpose of this study was to identify the core competencies of the Safety Professional (SP) at various stages of his / her career. To facilitate, this chapter was broken into four parts in order to examine each of these aspects in greater clarity. The first part identifies characteristics of safety professionals working in the United States. The second part focuses on core competencies of the SP. These competencies can be broken down further to: Knowledge, Skills, and Abilities (KSA). The third part identifies different career stages of the SP. These stages can be identified as: 1) Novice or entry-level, 2) mid-level, and 3) senior safety professionals. Lastly, the fourth part explores research and methods in use designed to measure the competencies of the SP.

To examine each of these aspects, and their respective subparts in greater detail, a comprehensive literature review was conducted. Specifically, multiple databases were explored, including data available through the Bureau of Labor Statistics (BLS), the American Society of Safety Engineer’s (ASSE) Body of Knowledge (BOK), EBSCO HOST, ProQuest, the GalaGroup’s Academic OneFile, and other sources.

Demographics of the Safety Profession

The information available from the BLS was particularly useful in quantifying and classifying the number of health and safety professionals in the United States (BLS, 2014). To summarize, the BLS estimates there to be roughly 110,000 safety professionals in the country. This total sum can be broken down into the following three groupings: 1) Safety technicians comprise of roughly 15,000, 2) Safety specialists make up roughly 70,000, and lastly 3) Safety engineers account for more than 25,000.
The Safety Health and Environmental (SH&E) Industry: 2015 Salary Survey also contributed to this research in the way of safety and health professional demographics (Readex Research, 2015). Here, it was found that the median age of the safety and health professional at 50 years (Readex Research, 2015). In addition, the study indicated that the median number of years as a safety and health professional was only 19 (Readex Research, 2015). This would suggest that many of the safety and health professionals currently in the workforce brought work experience with them from outside the safety and health profession.

It was also determined that the median age of the U.S. labor force at 41.9 (BLS, 2015); almost a full decade younger than the average safety professional. Furthermore, a study conducted on behalf of the National Institute of Occupational Safety and Health (NIOSH) has indicated that Occupational Safety and Health degree programs are not producing safety and health specialists, technicians, and engineers at the rate of industry growth (McAdams, Kerwin, Olivo, & Goksel, 2011).

**Analysis of Demographic Data**

Two inferences can be drawn from these facts: First, both historical data and industry forecasts suggest that a significant population of safety and health professionals have come, and will continue to be imported, from other trades and professions. Second, it is reasonable to conclude that retirement will result in the need for advancement across all levels of the safety and health profession, not just entry level positions, sooner than the mainstream U.S. workforce.
Core Competencies

Given the growing demand for safety professionals in the United States (BLS, 2014); coupled with the deficient volume of EH&S graduates (McAdams, et al., 2011) and the elevated potential for EH&S retirement when compared to the mainstream American labor force (Readex Research, 2015; BLS 2015), the focus of this research shifted to the Human Resource profession. Chiefly, this research began looking for a framework or methodology used by the HR profession for staffing vacant positions or anticipated openings. To a degree, this has already been accomplished. Namely, the HR profession uses a concept of competencies (Noe, et al., 2011; Bonder, et al., 2011). However, the human resource profession has been criticized for poorly defining and not consistently applying competency requirements as well as performance expectations (Kuhn, 2015; Ngah, 2016).

In an applied example that particularly relates to the safety and health profession, a similar shortcoming has been researched. Here, Minnick (2012) explored the concept of task ambiguity. It was stated that task ambiguity “results from lack of information concerning the proper definition of the job, its goals and the permissible means for implementing them” (Kakn et al., as cited by Minnick, 2012, p. 29). Although not directly related to defining competency requirements, the relevance here stems from the lack of definition that seems to be a reoccurring pitfall within the HR profession. Moreover, it stands to reason that if a HR department cannot define the job, they cannot begin to adequately define what competencies are required to perform that job.

Complicating matters further, research has found that HR practitioners tend to inconsistently apply HR practices (Kuhn, 2015). In addition, research also indicates that HR practitioners carry some stigma towards empirical research, favoring personal experience (Highhouse, 2008). Thus, measuring the effectiveness of any accepted competency system may be seen as a tenuous endeavor.
Despite these challenges, this research has made progress at defining competencies. In general, the HR literature agrees that competencies is a collective term and encompasses general subgroupings. Many have come to use the term KSA or KSAO. Research found definitions ranging from: Knowledge, Skills, and Abilities (Kuhn, 2015), to Knowledge, Skills and Personal Attributes (Bonder, et al., 2011), to Knowledge, Skills, Abilities, and Other Characteristics (Noe, et al., 2011; Stetz, Button, & Porr, 2009). Although there is some semblance of cohesion when it comes to defining the acronym, the definitions for each of these aspects varied, assuming a definition or elaboration was offered at all.

Upon further investigation, it was found that the KSA concept could not be claimed as an accomplishment of HR endeavors. Instead, some believe the KSA competency model to be a product of Bloom’s Taxonomy (Laird, 1985). If so, this would partially account for the discrepancy in terms. Specifically, as it relates to a training and development perspective, the trainer uses the concepts of Knowledge, Skills and Attitudes (KSA) for devising learning objectives (Lawson, 2009). This theme can be seen in many other instances including: *Instructional System* published by Fearon Publishers (1968); and *A System Approach to Training* produced by the U.S. Department of Defense (1988). The term Knowledge, Skills and Abilities (KSA) did not emerge until sometime later. The first example this research found was in the document: *A System Approach to Training* produced by the U.S. Department of Energy (1994).

This research concluded that each variation is likely an evolved adaptation designed to meet the needs of a given industry (e.g. government, military) and application (e.g. training, organizational staffing). Based on this, the definitions adopted by this research for the terms knowledge, skills, and abilities were largely shaped by the following.

**Knowledge**
Knowledge can be broken into two groupings. The first is known as explicit knowledge (Noe, 2010). This type of knowledge could also be labeled as general knowledge as it includes fundamental elements that can be cross applied to virtually anywhere. To illustrate, reading, writing, and mathematics would fall into this grouping.

The second grouping is tacit knowledge (Noe, 2010). This type of knowledge encompasses personal experience and other less easily defined elements (Noe, 2010). Persons rich in this type of knowledge would be well suited for troubleshooting and anticipating problems and systems or processes they are familiar with.

**Skills**

To a degree, skills can be seen as a cross between knowledge and abilities (DeSimone, et al., 2012). That is, persons with a skill set will carry applied knowledge about a task or group of tasks and the ability to perform those task(s). For instance, a licensed crane operator will have the knowledge to read gauges and dials, and understand signals related to crane activities. In addition, this operator will also have the physical abilities required to pull levers, use foot pedals, and discern color coded signals.

**Abilities**

For the competency of abilities, one's physical capacity to perform a task shall be considered (DeSimone, & Werner, 2012). This may be broken into two aspects. The first shall consider capabilities; whereas, the second will address restrictions. Some examples of capabilities may include: 1) Stand for extended periods of time; 2) reach overhead; and 3) lift and carry a specified volume of weight. Some examples of restrictions may include: 1) Colorblindness; 2) specified allergen vulnerabilities such as penicillin, iodine, etc.; 3) Special populations such as elderly, pregnant, etc. It should be noted, the reason for the classification of restrictions is
motivated by protecting workers and not discriminatory practices. For instance, a worker with an allergy to penicillin may not have the ability to work in a penicillin manufacturing facility depending on the scope of the job. Similarly, a woman who is pregnant may have restrictions preventing her from working in some areas of a nuclear power facility.

Career Stages of the Safety Professional

The concept of career stages can find its roots in the sub-field of psychology that focuses on adult development (Levinson, 1986). Here, Levinson introduces the concept of life course. Levinson explains that the word life includes “all aspects of living: inner wishes and fantasies; love relationships; participation in family, work, and other social systems; bodily changes; good times and bad – everything that has significance in a life” (Levinson, 1986, p. 4). Levinson also explains that “The word course indicates sequence, temporal flow…” (Levinson, 1986, p. 3). Thus, life course includes work sequence.

Evolving from concept of life stages, career stages began to emerge (Demerouti, Peeters, & van der Heijden, 2012). Largely, the concepts associated with career stages center around the work of Donald Edwin Super (Smart, & Peterson, 1997; Collin, & Patton, 2009; Demerouti et al., 2012). Career development can be broken into four stages (Smart, et al., 1997; Noe, 2010). Chronologically, those entering the workforce begin in the exploration phase (Smart, et al., 1997; Noe, 2010). These workers help and follow experienced workers in the tasks associated with the job. These workers may spend the next several years determining what career path they would like to embark on. As stated previously, safety professionals often bring work experience with them. Thus, safety professionals do not typically fall into this category.
Novice / Entry-Level Safety Professionals

Once the worker has identified and launches into viable career path, he or she enters the establishment stage (Smart, et al., 1997; Noe, 2010). According to Noe (2010), a worker may spend between two and ten years in this phase before advancing. This can be because it takes time to learn the nuances and finer points of one’s career path or because finding a good fit within a career may take some time. Safety professionals at this stage will be classified as entry-level or novices for the purposes of this research.

Mid-Level Safety Professionals

Next, workers advance into the maintenance stage (Smart, et al., 1997; Noe, 2010). These individuals have mastered the basic skills needed to perform their trade or profession. In contrast, these workers continue to hone their competencies as a means of staying current with changing practices and technologies. Applied to the safety professional, this may be manifested in the form of obtaining or maintaining credentials. For the purposes of this research, safety professionals at this stage shall be referred to as mid-career safety professionals.

Senior-Level Safety Professionals

Lastly, workers may advance to the disengagement stage (Smart, et al., 1997; Noe, 2010). These workers may be encouraged to take on a protégé to train as their replacement. Although this stage is traditionally viewed as preparing for retirement, these individuals may simply shift into the role of mentoring or coaching. For the purposes of this research, however, this category shall include mentors and coaches, as well as high-level safety executives, Subject Matter Experts (SME), and other peak safety positions. This research shall refer to these safety professionals as: Senior safety professionals.
Measuring the Competencies of the Safety Professional

With a better understanding of the HR related challenges, and the scope of this research, it was the decision of this researcher to conclude this literature review with the findings of similar studies. The most notable study was the National Assessment of the Occupational Safety and Health Workforce (NASHW) report that was prepared for the National Institute for Occupational Safety and Health (NIOSH) (McAdams, et al., 2011). A breakdown of the NASHW report follows.

Overview of the NASHW Report

The purpose of the 2011 NASHW was to provide NIOSH with the insight for determining where future funding, in the form of university-based programs and grants, would be most effectively placed (McAdams, et al., 2011). The interests of NIOSH are far broader than those of this study. Specifically, NIOSH supports nine distinct disciplines: Occupational safety, industrial hygiene, occupational medicine, occupational health nursing, health physics, ergonomics, occupational epidemiology, occupational health psychology, and occupational injury prevention. In contrast, this research is focused exclusively on the first category of occupational safety. This single category represented 59% of the NASHW sample population (McAdams, et al., 2011).

Additionally, the NASHW report took the approach of interviewing the employer’s representative most knowledgeable about the organizational OS&H activities; some examples include staffing considerations, and training needs. In comparison, this research included any willing safety professionals with at least one year of experience as a full-time safety professional. In addition, this research focused on assessing the competencies the participating safety professional believed to be of value at various stages of the safety professional’s progression. Further, like the HR literature that was reviewed, the competencies known as Knowledge, Skills,
and Abilities (KSA) were mentioned frequently, but again, no definitions for these terms were provided (McAdams, et al., 2011).

Lastly, the NASHW report concluded that employers tended to be happy with the competencies held by their safety professionals. However, it was also noted that employers would like to see additional developed competencies in their new hire selections. Also, the report found that employers have a preference for applicants holding a four year degree (McAdams, et al., 2011).

**Johnson & Johnson Competency Methodology**

Internally, Johnson & Johnson (J&J) developed a system known as: Global health and safety competency model (Cable, 2006). This system was designed to be modular in nature, allowing site specific characteristics to define the needs of a given safety and health professional for that station. This method has two categories known as: 1) Technical competencies, and 2) Leadership skills (Cable, 2006). The first category, which J&J also refers to as technical knowledge, skills, and abilities (KSA), is comprised of eight (8) individual competencies: 1) Hazard identification; 2) Risk assessment (qualitative and quantitative); 3) Exposure control; 4) Training and development; 5) Safety through design; 6) J&J standards; 7) Regulatory compliance; and 8) Emergency prep and response (Cable, 2006).

Using this eight (8) competency model as a baseline, the depth of each competency can be addressed. This aspect is similar to that of Bloom’s taxonomy model where level of understanding and proficiency on a given subject matter can be determined (Adams, 2015). In the case of J&J’s model, level one indicates a basic or fundamental knowledge of a subject. Level two indicates a fundamental knowledge and the ability to problem solve minor issues related to the subject; whereas level three indicates an advanced understanding and the ability to develop and implement
complex solutions (Cable, 2006). In short, this system addresses both the depth and breadth of competencies required by SPs working for J&J.

Chapter Analysis and Conclusion

The demographics section of this chapter found three significant aspects of the SP in the United States. First, at the time of this study, the safety profession was forecasted to grow at a rate equal to or greater than the American workforce average. Second, the median age of the American SP was found to be almost 10 (ten) years greater than that of the American workforce. This suggests that the need for legacy / succession planning will impact the safety profession sooner than other industries. Lastly, at the time of this study, it was found that colleges and universities were not forecasted to produce safety and health graduates in volumes adequate to keep up with industry demand. Thus, both human resource groups and emerging safety professionals will benefit from a comprehensive mapping of the core competencies of the American safety professional.

Second, this chapter explored the various stages of career progression. Ultimately, this research adopted three (3) distinct categories of progression: 1) Novice / Entry-Level safety professional, 2) Mid-Level safety professional, and lastly 3) Senior-Level safety professional. Next, this chapter shifted focus towards the human resource profession by attempting to identify a standardized method of job analysis. Instead of finding a results based framework rooted in empirical research, this research found an intuition based approach to navigating poorly defined concepts and terms. As a result, this research developed a set of definitions for the competencies of Knowledge, Skills, and Abilities (KSA) as they relate to the safety professional.

Lastly, this chapter explored the NASHW report, conducted on behalf of NIOSH, to determine the desired competencies of a variety of professions as they relate to the safety and
health profession. Although the NASHW report did provide many insights, its focus was too broad to be applied to a single profession. In addition, this report only interacted with safety professionals that would be classified as senior by this research and not the mid-level or entry-level safety professionals. This chapter also highlighted significant elements of the framework developed by Johnson & Johnson for measuring both the depth and breadth of eight (8) predetermined competencies required by various safety and health positions within their organization.

In conclusion, developing and adopting functional definitions was only the first step. The research hypotheses and the statistical procedures to test them came next and can be found in the following chapter.
CHAPTER 3
METHODOLOGY

Introduction

Setting of the Study

The purpose of this study was to measure the Knowledge, Skills, and Abilities (KSA) of safety professionals based on their career progression from Entry-Level to Mid-Level to Senior-Level status. This study used a survey instrument to collect safety professionals’ (SP) perceptions about the content/areas they believe SPs should have under each of the aforementioned three areas. Another purpose of the study was to determine whether or not there was an agreement on the set of KSA identified by one group of SPs to themselves versus the rest of the study population. To facilitate, the survey instrument was introduced. Lastly, the statistical procedures to be used were also considered and introduced in this chapter.

Study Sample

The study sample included all safety professionals at all levels of career progression. These levels have been broken into the groupings of: Entry-Level, Mid-Level, and Senior-Level safety professionals. Participants must be full-time safety professionals; meaning, that safety and health activities make up the majority of their day to day activities. The geographical location of this study was focused in the northeastern United States. Both male and female safety professionals were included in the study. Participants were required to indicate that they were at least eighteen (18) years of age and had at least one year of experience as a full-time safety professional prior to beginning the survey.

Initially, 600 surveys were distributed in hopes of recovering at least fifty percent which is adequate for analysis and reporting (Leedy & Ormrod, 2013). After two weeks, a follow up email
was distributed with access to the survey link to thank participants that had completed the survey and to remind those that had not to complete the survey. A power analysis was conducted to check for the adequacy of the sample size.

Pilot Study

To improve the validity of the results, this research included a pilot study. Here, seven (7) participants were included. The participants were comprised of both safety professionals (SP) and non-safety professionals. The pilot testers were asked take the proposed survey. The pilot testers were also asked to focus on the content aspects such as the clarity of the questions asked and the technical accuracy of the survey. The non-SPs were asked to focus on the grammar and the general flow of the questionnaire. Afterwards, each pilot tester was interviewed individually to collect feedback. The feedback was then used to improve the survey. Some examples include changing some of the question wording for clarity and the correction of some spelling errors. Afterwards, the pilot study participants were thanked for their participation and instructed not to participate in the actual study once it was approved and became available.

Survey Instrument

Survey Setting

For this research project, a survey was developed as the means of obtaining data. The goal was to collect at an acceptable response rate of 50% of the 600 surveys that were distributed. A power analysis was conducted using the G-Power software version 3.1.7 to verify an adequate number of respondents is collected. The survey was conducted using Qualtrics software. At the beginning of the survey a statement indicating the purpose of the survey, stating that the survey is voluntary, and thanking the potential participant for their time and interest was included. In addition, the participant was required to indicate that they were at least 18 years of age and that
they have at least one year of full-time safety experience before they were permitted to begin the survey. A copy of this statement and the survey can be found in Appendix A and B, respectively.

The researcher utilized participant safeguard features offered by the Qualtrics. For instance, the survey was distributed using an anonymous hyperlink. That is, a hyperlink that does not collect personal data such as IP address.

**Survey Benchmarking**

Due to the focus in the Northeastern United States and the relatively small scale of the survey, the researcher was concerned that the survey results had the potential for bias. Therefore, demographic information regarding: Age, gender, work experience, and level of education were included into the survey. The researcher did this with the intent to benchmark the results of this survey against the findings of the Readex Research (2015) SH&E Industry 2015 salary survey.

**IRB Approval**

The survey and the Institutional Review Board (IRB) application were submitted to the Indiana University of Pennsylvania (IUP) IRB for approval. While waiting for approval, the research leader compiled a list of names and email addresses of survey candidates. The candidate pool was made up of personal acquaintances made through professional organizations such as the American Society of Safety Engineers (ASSE) and the National Safety Council (NSC) with a safety and health background, colleagues working in the safety and health industry, and classmates also working in the safety and health profession. The IRB codified the proposal as Log No. 16-312; and on December 20th, 2016, the IRB granted written approval. That day, the research leader distributed the survey to the complied candidate list. In addition, a marketing campaign was also launched using the social media site LinkedIn. Two weeks later, a follow up blast was disseminated. This follow up blast thanked those who
participated, acted as a reminder for those that did not, and also asked participants to share the hyperlink with others they thought would be interested and eligible for participating in the survey. In response, the leadership of the Maine and Western Pennsylvania Chapters of the American Society of Safety Engineers (ASSE) contacted the research leader directly to coordinate informal ad hoc marketing campaigns within their chapters.

Data Analysis

The data from the study was analyzed using the IBM SPSS Version 23 software package. The variables were examined using descriptive statistics as well as inferential statistics.

For each individual tested hypothesis, the specific method of statistical analysis was described as follows in an attempt to answer the previously described research questions. Again, the IBM SPSS Version 23 software package was utilized for analysis.

Descriptive Statistics

Descriptive statistics were used to summarize the competency types as well as demographic data across all safety professional levels for the analysis of trends. These descriptive statistics include the mean and percentages. Outlier tests for normality were also conducted.

Inferential Statistics

Inferential statistics were used to answer the research questions posed in this study. For all tests, an Alpha level of 0.05 was used to determine significance. Main independent variables are as follows:

Safety professional career level. It is a nominal variable with three (3) levels; Entry-Level, Mid-Level, and Senior-Level safety professionals.
Knowledge. Nominal variable with three (3) levels; education (nominal with five (5) levels), training (nominal with six (6) levels), and credentials (nominal with ten (10) levels).

Skills. Nominal with three (3) levels; behavior (nominal with five (5) levels), hard (nominal with five (5) levels), and soft (nominal with ten (10) levels) skill sets.

Ability. Nominal with seven (7) levels.

The dependent variable is a ranking of the core competencies on a Likert scale of one (1) to ten (10); with one (1) being that participant strongly agrees, and ten (10) indicating that the participant strongly disagrees. Even though this variable is ordinal, it will be treated as continuous. Such a practice has been found to be acceptable (Rhemtulla, Brosseau-Liard, & Savalei, 2012). Therefore, the assumption for an ANOVA was tested as follows:

First. The dependent variable was measured on a continuous scale (i.e. it is measured at the interval or ratio level).

Second. The independent variable consists of two or more categorical, independent groups.

Third. There is independence of observations meaning that there is no relationship between the observations in each group or between the groups themselves.

Fourth. There should be no significant outliers in the differences between the two related groups.

Fifth. The dependent variable should be approximately normally distributed for each category of the independent variable.

Sixth. There is homogeneity of variances.

Assumptions one (1), two (2), and three (3) will be met by the design of the study. Assumption four (4), no significant outliers, will be investigated using a histogram and box-plot
generated by SPSS software. Assumption five (5), normal distribution, will be determined for residuals using a Shapiro-Wilks test and normal Q-Q plots as generated by SPSS for the residuals. If data is not normal, then data transformation will be applied, such as inverse, natural log, power, etc. in an attempt to obtain normality, if applicable. Assumption six (6), homogeneity of variances, will be determined using Levene’s test.

If assumptions five (5), six (6), or both are not met, then the data will be treated as non-parametric. That is, the data is not considered normal, or as not following specific distribution criteria (Sullivan, 2011; Janicak, 2007). In this case, the Kruskal-Wallis test will be used. Kruskal-Wallis test (H) is a non-parametric test. This test is used when data is not normally distributed as it is based on medians and not the means (Emerson, 2016).
CHAPTER 4

RESULTS

The purpose of this research was to map out the knowledge, skills, and abilities (KSA) of safety professionals (SP) at the Entry-Level, Mid-Level, and Senior-Level stages of their career progression. To accomplish this, an electronic survey was piloted and conducted. The specific steps are outlined in the sections that follow.

Data Collection

The survey was made available on-line for 58 days. During that time, 210 respondents began the survey. Conversely, 168 respondents completed the survey. Of these remaining respondents, not all shared some details of their demographic data; for instance, gender. As a result, this research elected to present data using the valid percentages.

Descriptive Statistics

Demographic Information

Age demographics. Of the 210 respondents, only 168 identified their age on the survey. Of those that did elect to respond, 58% were between the age of 46 and 65 years old, and only 3% in the eldest group of 65 years or older. The age bracket demographics can be found in Figure 1.
Figure 1. Age distribution.

**Gender demographics.** Of the 210 respondents, 166 respondents that indicated their gender on the survey as shown in Figure 2. 72.89% indicated they were male; whereas, 27.11% indicated they were female.
Figure 2. Gender distribution.

Location demographics. Of the 210 respondents, only 161 shared the location demographics. The majority of the respondents were found to primarily work in the Northeastern United States. The three largest states represented are: New York with 45.3%, Pennsylvania with 16.1% respondents, and Maine with 8.1%. The location demographics can be found in Figure 3.
**Figure 3.** Geographic location distribution.

**Work experience demographic.** 68.5% of respondents indicated that they have 21 years or more work experience in the SH&E industry. By way of comparison, 48% of respondents from the Readex Survey were identified in the same experience brackets. A bar graph depicting both sets of data can be found in Figure 4.

**Figure 4.** Work experience distribution.
**Industry demographics.** The four largest segments identified themselves as construction at 29%, manufacturing at 19% and as general industry at 13% as well as insurance and loss control at 13% as shown in Figure 5 below.

![Figure 5. Industry Distribution.](image)

**Education.** Next, participants were asked to indicate their level of education. The majority of respondents, at 45.24%, indicated that their highest level of education was a bachelor’s degree. At 36.31%, respondents indicated that they had completed a master’s degree. Lastly, 2.38% of respondents indicated they had obtained a doctoral degree. The response data for these three levels were within one percent of those published by the Readex Research (2015) survey. For a graphic illustration, see Figure 6.
Participants were then asked to indicate the area of study their degree highest conferred degree was in. 49% indicated that their major was in the fields of safety, health, environmental, or ergonomics. At 14%, the second largest area of study was business, management, administration, or law. See Figure 7.

Figure 6. Education level distribution.

Participants were then asked to indicate the area of study their degree highest conferred degree was in. 49% indicated that their major was in the fields of safety, health, environmental, or ergonomics. At 14%, the second largest area of study was business, management, administration, or law. See Figure 7.

Figure 7. Area of study.
**Training.** Next, participants were asked to indicate how many hours per year they spend in training that resulted in a completion certificate such as: OSHA 10-hour course, HAZWOPER 40-hour course, First Aid, and CPR /AED. About 45% of the respondents indicated that they have more than 20 hours of annual training as depicted in Figure 8.

![Figure 8. Annual training.](image)

**Certifications.** Participants for this research indicated that almost 32% did not have a safety related certification and that 66% did not hold a non-related safety certification. Additionally, almost 50% indicated that they held 1-2 safety related certifications, and almost 26% indicated that they held non-related safety certifications. Similarly, to ensure that safety professional holding a higher or lower than average number of safety credentials did not bias the data, a comparison was also made with the results of the Readex Research (2015). For instance, the Readex Research report found that 11% of their respondents did not hold a professional license or certification. In addition, they reported that 73% of their respondents held 1-2 professional licenses or certifications. However, the results differ somewhat. To illustrate, the Readex Research report did not indicate if the certifications participants held were exclusively related to the safety and health profession. Additionally, quantities were grouped differently.
Figure 9. Professional certifications.

Figure 10. Readex Research (2015) Credential Results.
Inferential Statistics

After conducting a power analysis, it was found that several dependent variables from the collected data were not normally distributed. Here, it should be noted that the fifth assumption, as outlined in the methodology chapter of this paper, required a normal distribution of data in order for the use of ANOVA. Therefore, non-parametric testing was warranted. Here, the researchers proceeded with the Kruskal-Wallis test at $\alpha$ level of 0.05. The mean rankings for each safety related skill competency at each career stage has been recorded (Table 1).
Table 1

*Kruskal-Wallis Mean Rankings by Career Stage*

<table>
<thead>
<tr>
<th>Skill</th>
<th>Entry-Level Mean-Ranks</th>
<th>Mid-Level Mean-Ranks</th>
<th>Senior-Level Mean-Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entry-Level1</td>
<td>Mid-Level2</td>
<td>Senior-Level3</td>
</tr>
<tr>
<td>Fire Science</td>
<td>73.00</td>
<td>59.87</td>
<td>56.24</td>
</tr>
<tr>
<td>Industrial Hygiene</td>
<td>65.21</td>
<td>62.80</td>
<td>54.29</td>
</tr>
<tr>
<td>Accident Investigation</td>
<td>62.66</td>
<td>59.75</td>
<td>62.84</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>67.39</td>
<td>62.15</td>
<td>52.55</td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td>79.47</td>
<td>60.92</td>
<td>46.61</td>
</tr>
<tr>
<td>Adult Education – Management Applications</td>
<td>78.29</td>
<td>60.26</td>
<td>54.08</td>
</tr>
<tr>
<td>Adult Education – Technical Applications</td>
<td>70.39</td>
<td>61.23</td>
<td>54.73</td>
</tr>
<tr>
<td>EHS Management Systems – Management Applications</td>
<td>69.11</td>
<td>61.75</td>
<td>56.26</td>
</tr>
<tr>
<td>EHS Management Systems – Technical Applications</td>
<td>70.89</td>
<td>60.24</td>
<td>58.68</td>
</tr>
<tr>
<td>Lines of Insurance</td>
<td>76.79</td>
<td>57.30</td>
<td>57.75</td>
</tr>
<tr>
<td>Regulatory Compliance</td>
<td>67.89</td>
<td>61.96</td>
<td>54.33</td>
</tr>
<tr>
<td>Risk Assessment / Hazard Identification</td>
<td>68.63</td>
<td>61.75</td>
<td>56.55</td>
</tr>
<tr>
<td>Emergency Preparedness and Response</td>
<td>74.66</td>
<td>61.00</td>
<td>52.63</td>
</tr>
</tbody>
</table>

1Column indicates the Entry-Level SPs rating of Entry-Level SPs.  
2Column indicates the Mid-Level SPs rating of Entry-level SPs.  
3Column indicates the Senior-Level SPs rating of Entry-Level SPs.  
4Column indicates the Entry-Level SPs rating of Mid-Level SPs.  
5Column indicates the Mid-Level SPs rating of Mid-Level SPs.  
6Column indicates the Senior-Level SPs rating of Mid-Level SPs.  
7Column indicates the Entry-Level SPs rating of Senior-Level SPs.  
8Column indicates the Mid-Level SPs rating of Senior-Level SPs.  
9Column indicates the Senior-Level SPs rating of Senior-Level SPs.
### Table 2

Kruskal-Wallis Results for Applied Skills

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Entry-Level P-value</th>
<th>Mid-Level P-value</th>
<th>Senior-Level P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The distribution of knowledge of fire science is the same across all categories of level.</td>
<td>0.226</td>
<td>0.071</td>
<td>0.163</td>
</tr>
<tr>
<td>The distribution of knowledge of industrial hygiene is the same across all categories of level.</td>
<td>0.438</td>
<td>0.443</td>
<td>0.321</td>
</tr>
<tr>
<td>The distribution of knowledge of accident investigation / incident analysis is the same across all categories of level.</td>
<td>0.895</td>
<td>0.581</td>
<td>0.936</td>
</tr>
<tr>
<td>The distribution of knowledge of ergonomics is the same across all categories of level.</td>
<td>0.271</td>
<td>0.257</td>
<td>0.234</td>
</tr>
<tr>
<td>The distribution of knowledge of hazardous materials is the same across all categories of level.</td>
<td><strong>0.005</strong>*</td>
<td><strong>0.000</strong>*</td>
<td><strong>0.017</strong>*</td>
</tr>
<tr>
<td>The distribution of knowledge of adult education – management applications is the same across all categories of level.</td>
<td>0.054</td>
<td><strong>0.007</strong>*</td>
<td>0.391</td>
</tr>
<tr>
<td>The distribution of knowledge of adult education – technical is the same across all categories of level.</td>
<td>0.298</td>
<td>0.086</td>
<td>0.365</td>
</tr>
<tr>
<td>The distribution of knowledge of EHS – Management is the same across all categories of level.</td>
<td>0.451</td>
<td>0.329</td>
<td>0.733</td>
</tr>
<tr>
<td>The distribution of knowledge of EHS – Technical is the same across all categories of level.</td>
<td>0.434</td>
<td>0.686</td>
<td>0.708</td>
</tr>
<tr>
<td>The distribution of knowledge of lines of insurance is the same across all categories of level.</td>
<td>0.079</td>
<td><strong>0.049</strong>*</td>
<td><strong>0.014</strong>*</td>
</tr>
<tr>
<td>The distribution of knowledge of regulatory compliance is the same across all categories of level.</td>
<td>0.385</td>
<td>0.158</td>
<td>0.071</td>
</tr>
<tr>
<td>The distribution of knowledge of risk assessment / hazard identification is the same across all categories of level.</td>
<td>0.492</td>
<td>0.936</td>
<td>0.891</td>
</tr>
<tr>
<td>The distribution of knowledge of emergency preparedness is the same across all categories of level.</td>
<td>0.094</td>
<td>0.160</td>
<td>0.135</td>
</tr>
</tbody>
</table>

* Indicates significance at $\alpha$ level of .05.
CHAPTER 5
DISCUSSION AND CONCLUSION

Research Summary

To summarize, this research project set out with the goal of mapping the competencies required by safety professionals at various stages of their career progression. During the literature review portion of this research, this was broken into two parts. First, the method for mapping competencies came from adapting the concept of Knowledge, Skills, and Abilities (KSA) as adapted to meet the needs of various industries and applications (Laird, 1985; Lawson, 2009; DOD, 1988; DOE, 1994). Second, the approach for mapping career stages came from the sub-field of psychology focused on life stages (Levinson, 1986; Demerouti et al., 2012; Smart & Peterson, 1997; Collin & Patton, 2009). With this information, the researcher adopted one research question and articulated a research hypothesis to test the research question.

Descriptive Data

Age Comparison

Descriptive statistics indicated that around 58% of the sample population is concentrated between the age of 46 and 65 years old. These results are consistent with the data collected by Readex Research SH&E Industry survey (2015) as shown in Figure 10. Based on Readex’s 9,042 respondents, the mean population of their survey was found to be 48.8 years of age. Accordingly, the age distribution of this sample result is a good representation of the study population, so the possibility of the bias caused by the 58% group is greatly reduced.
Additionally, it was also found that the majority of the participants were males (73%). To ensure this high percentage of male participants did not bias the data, the results were also found to align with the data reported by Readex Research SH&E Industry survey (2015), which indicated that 81% of the EH&S participants were males.

Gender Comparison

Additionally, it was also found that the majority of the participants were males (73%). To ensure this high percentage of male participants did not bias the data, the results were also found to align with the data reported by Readex Research SH&E Industry survey (2015), which indicated that 81% of the EH&S participants were males.

Research Hypotheses

The researcher postulated that safety professionals would have consensus towards the KSA competency requirements for their stage of career progression. Referring back to the research question posed in Chapter 3 of this paper, this research question was presented:

**RQ:** Did the respondents agree on a consistent set of specialized competencies for every career stage?
Applied Skills Rating by Career Stage

Another aspect considered by the researcher was the rating of applied skills that each career stage considered to be most important to their level. The top three averaged score / rating results for each career stage can be found in Table 3. A complete listing of all 13 applied skills for each career stage can be found in Appendix E.

Table 3

Applied Skills Average Rating

<table>
<thead>
<tr>
<th>Career Stage</th>
<th>Skill</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry-Level</td>
<td>Risk Assessment / Hazard Identification</td>
<td>5.94</td>
</tr>
<tr>
<td></td>
<td>Accident Investigation / Incident Analysis</td>
<td>5.79</td>
</tr>
<tr>
<td></td>
<td>Regulatory Compliance</td>
<td>5.57</td>
</tr>
<tr>
<td>Mid-Level</td>
<td>Risk Assessment / Hazard Identification</td>
<td>7.38</td>
</tr>
<tr>
<td></td>
<td>Accident Investigation / Incident Analysis</td>
<td>7.27</td>
</tr>
<tr>
<td></td>
<td>Regulatory Compliance</td>
<td>7.14</td>
</tr>
<tr>
<td>Senior-Level</td>
<td>Safety and Health – Management (e.g. policy development &amp; trending)</td>
<td>8.15</td>
</tr>
<tr>
<td></td>
<td>Risk Assessment / Hazard Identification</td>
<td>8.10</td>
</tr>
<tr>
<td></td>
<td>Accident Investigation / Incident Analysis</td>
<td>7.98</td>
</tr>
</tbody>
</table>

When ranking the skills participants found to be the most important for their level, Entry-Level and Mid-Level safety professionals identified the same top three skills, in the same order: 1) Risk Assessment / Hazard Identification, 2) Accident Investigation / Incident Analysis, and 3) Regulatory Compliance. Senior-Level safety professionals on the other hand, bumped the first and second picks of the other career stages down to second and third place, favoring Health – Management (e.g. policy development & trending) as their number one pick.
These findings are consistent with research conducted on behalf of NIOSH (McAdams et al., 2011). In the NIOSH report, researchers asked employers what additional training would benefit the occupational safety professionals that work for them. The employers indicated: “measuring safety program outcomes, job safety analysis, investigating accidents, and ergonomics” (McAdams et al., 2011, p.128).

Results from the Kruskal-Wallis test indicated that there was group consensus on 33 of the 39 applied skills across all stages of career development (p > .05). Five of the conflicted result outcomes were concentrated in two applied skill areas. First, all three career stages were in disagreement in regard to the applied skill of hazardous materials. Second, the Mid-Level and Senior-Level career stages were in conflict in regard to the applied skill of lines of insurance. The lack of consensus may be explained by reasons.

First, some safety professionals may be required to perform tasks associated with hazardous materials or lines of insurance far greater than others; thus, potentially creating a bias. For instance, safety professionals employed by an abatement contractor or a loss control agency would understandably require a higher level of proficiency in the perspective skill competency than safety professionals employed elsewhere.

Second, the terms “hazardous materials” and “lines of insurance” can be interpreted to have many levels of meaning. For instance, one safety professional, when asked about hazardous materials may have envisioned their employer’s Hazardous-Communication program; whereas, another safety professional may have visualized a team of hazardous material technicians engaged in mitigation activities.

In any case, the reason for the lack of consensus is unknown. Therefore, to make such a determination, further research would be needed.
Implications to the Safety Profession

Importance of the Research

The importance of this research stems from three factors. First, the average age of the working SP is almost ten years higher than the average working American (Readex Research, 2015; BLS, 2015). Thus, the need for succession planning will impact the safety profession before the mainstream American workforce. Second, safety and safety related degree programs have forecasted a gap in the number of graduates when measured against the demand for safety professionals (McAdams, et al., 2011). Lastly, because of these first two factors, emerging safety professionals (professionals branching over from other career paths into the safety profession) will continue to be relied upon. Given these factors, both the human resource profession and safety professionals seeking employment or advancement can benefit from the mapping of competencies at different stages of career progression that was performed during this research.

Importance of the Findings

Based on the data collected from survey respondents, 45% of the participants have a bachelor’s degree and roughly 36% have a master’s degree. Additionally, 49% of respondents hold 1-2 safety related certifications (e.g. Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH), Certified Professional Ergonomist (CPE), etc.). Thus, in terms of general demographics, it can be seen that safety professionals place an elevated emphasis on higher and continued education.

By way of applied skills (skills directly related to the safety profession), respondents found the following two competencies to be of significant importance, regardless of their current career stage: 1) Risk Assessment / Hazard Identification, 2) Knowledge of Accident Investigation / Incident Analysis skills.
In summary, those wishing to enter the safety profession, or those already in the profession aiming to advance their careers, would do well to develop themselves in two ways. First, to advance their college education and pursue earning a safety related credential. Second, to hone the applied skills of risk assessment / hazard identification and accident investigation / incident analysis skills.

Conclusion

This researcher agrees with the findings of Erickson (2016) that Safety Professionals with diverse skill sets bring additional tools to their organization for solving and troubleshooting problems. Thus, a continued influx of emerging safety professionals; that is safety professionals transferring over from other career paths, can be an asset for strengthening both the safety profession as a whole, and the organizations they work for. However, it is reasonable to assume that a baseline set of competencies, both directly and indirectly related to the safety profession will be required by organizations aiming to staff vacant safety professional positions at each stage of career development. Therefore, the significance of this research can aid emerging safety professionals savvy enough to assess their competencies and willing to shore their weaknesses. In addition, existing safety professionals’ hopeful to advance their careers can adopt this same strategy, by identifying the competencies needed at their current career stage and or their target career stage.

The need for such an approach will continue to grow as the median age of the working safety professional, 50 years of age (Readex Research, 2015), approaches the prospects of retirement almost a decade before the median age of the average American worker, 41.9 years of age (BLS, 2015). Thus, the safety profession will be faced with the need for succession planning sooner than other elements of the American workforce.
Future Research

This study serves as a baseline measure of the Knowledge, Skills, and Ability (KSA) competencies of the safety professional at various stages of career progression. It is the intent of this researcher to use this research project as a stepping stone for future research in the same subject area. To this end, the researcher intentionally designed the survey instrument to collect a wide degree of data for future use. Moreover, by using an incremental approach, this research discovered some points worthy of further pursuit. Specifically, the lack of agreement between safety professionals towards the applied skill of hazardous materials, and lines of insurance may be due to clashing industry norms.

In contrast, the consensus amongst safety professionals for the need of accident investigation / incident analysis skills also warrants further attention. Here, the researcher may conduct an additional survey of safety professionals. To begin, such a survey could present a series of organizational stakeholders such as: Safety professionals, rank and file workers, front line supervisors, middle management, and senior leaders, at the Entry-Level, Mid-Level, and Senior-Levels. Then the participant could be asked to rank the level of competency for each of these stakeholders using the scale that follows:

1) this position does not need experience or training on this subject;
2) this position should have received training or education in this subject;
3) this position should have experience practicing this skill under direct supervision;
4) this position should have experience practicing this skill with little supervision;
5) this position should have experience leading teams in using this skill;
6) this position should be considered a subject matter expert, teaching others this skill.
References

Adams, N. (2015). Bloom’s taxonomy of cognitive learning objectives. *Journal of the Medical Library Association*. 103(3), 152. doi: [http://dx.doi.org/10.3163/1536-5050.103.3.010](http://dx.doi.org/10.3163/1536-5050.103.3.010)


[http://www.asse.org/assets/1/7/F1_1116.pdf](http://www.asse.org/assets/1/7/F1_1116.pdf)


Rhemtulla, M., Brosseau-Liard, P., & Savalei, V. (2012). When Can Categorical Variables Be Treated as Continuous? A Comparison of Robust Continuous and Categorical SEM


Appendix A
Informed Consent Form

Dear Participant,

I am a graduate student in the M.S. Safety Sciences program at the Indiana University of Pennsylvania. I am conducting a study to measure the Knowledge, Skills, and Abilities (KSA) used by safety professionals at various stages of their careers. The goal will be to aid safety professionals both working in the field and just entering the field identify what KSAs are most beneficial at their current stage of development, as well as to prepare for advancement.

The survey should only take about ten minutes to complete. The survey is anonymous and no personal information will be collected. In addition, none of the individual surveys shall be shared outside of the research group. In short, there is no risk to you by participating in this research survey. The survey is also voluntary; meaning, you do not have to participate. Thank you for your willingness to contribute to this research.

By selecting "I Agree" option below, you are agreeing to participate in this survey, confirming that you are a full-time safety professional, and that you are at least 18 years of age.

Do you agree to voluntarily participate?
Appendix B
Survey Instrument

Please complete the following demographic questions:

1. What age bracket do you fall in?
   a. 25 or younger
   b. 26 – 35
   c. 36 – 45
   d. 46 – 55
   e. 56 – 65
   f. 66 or older

2. Please indicate your gender:
   a. Female
   b. Male

3. Please Indicate the state or providence you predominantly work in:

                                                 __________________________

4. Please identify the industry you identify most closely with (e.g. construction, health care, etcetera):

                                                   __________________________

5. Please Indicate your highest level of education:
   a. High school diploma or equivalent
   b. Associates degree
   c. Bachelor’s degree
   d. Master’s degree
   e. Doctoral degree

6. Using your highest degree conferred, what category best describes your programs major?
   a. Safety, health, environmental, ergonomics
   b. Engineering, or engineering technology
   c. Natural, physical, and health sciences
   d. Medicine, nursing, health technology
   e. Business, management, law
   f. Industrial technology
   g. Liberal arts, education, psychology, social sciences
   h. Other, specify: _________________________________________________
7. Roughly how many hours of formal training that results in a completion card or certificate, do you estimate you attend per year (examples: OSHA 10-hour, HAZWOPER 40-hour, first aid certification, CPR certification.)
   a. Less than 10 hours
   b. 10 – 25 hours
   c. 26 – 50 hours
   d. 51 – 75 hours
   e. 76 – 100 hours
   f. More than 100 hours

8. How many certifications do you hold directly related to the safety and health profession (Examples: Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH), Certified Professional Ergonomist (CPE), etc.)
   a. None
   b. 1-2
   c. 3-4
   d. 5-6
   e. More than 6

9. How many certifications do you hold that are not directly related to the safety and health profession? (Examples: Professional Engineer (PE), Certified Project Management Professional (PMP), SHRM Certified Professional (SHRM-CP)).
   a. None
   b. 1-2
   c. 3-4
   d. 5-6
   e. More than 6

10. How many years of work experience do you have? (All work experience):
    a. Less than 5
    b. 6-10
    c. 11-15
    d. 16-20
    e. 21-25
    f. 26-30
    g. More than 30

11. How many years of safety and health experience do you have? (S&H experience only):
    a. Less than 5
    b. 6-10
    c. 11-15
    d. 16-20
    e. 21-25
    f. 26-30
    g. More than 30
12. Please rank the following statements from most important (1) to least important (27), in terms of how you feel they contribute to the success of the Safety Professional for all of the three (3) career levels identified:

<table>
<thead>
<tr>
<th>Core Competencies</th>
<th>Novice</th>
<th>Mid-Career</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1: Knowledge Competencies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong understanding of the following basic math skills: Algebra, trigonometry, geometry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong understanding of the following advanced math skills: Statistics, probability, calculus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong understanding of the following science skills: Chemistry, biology, earth science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong understanding of the following engineering principles: physics, electricity / magnetism, radiation, thermodynamics, and others.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part 2: General Skill Competencies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be proficient with computers and technology.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be proficient in written communication. Examples: Technical writing, reports, memos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be proficient with oral communication. Examples: Presentations, conducting meetings, speeches, and similar activities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be motivated and goal driven.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership: Should possess effective coaching and mentoring skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership: Should be able to motivate and inspire others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should have the following soft skills: Highly organized, adaptive, problem solver, time management, planning, and other similar skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should have the following soft skills: Problem solving, analytical and reasoning, logic, and other similar skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be able to work in teams / collaboratively.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be able to work individually.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part 3: Applied Skill Competencies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Science (Including fire protection and prevention)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Hygiene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accident Investigation / Incident Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ergonomics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Education / Training – Management (e.g. needs assessment)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Education / Training – Technical (e.g. delivering presentation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and Health – Management (e.g. policy development &amp; trending)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and Health – Technical (enforcement, monitoring, reporting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lines of Insurance (general/professional liability, workers’ comp, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulatory Compliance for applicable enforcement agencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Assessment / Hazard Identification and Control methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Preparedness and Response</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. Which of the three (3) types of safety professional do you identify yourself with? (Select only one)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A)</strong></td>
<td>These safety professionals (SP) may have vast experience in other areas outside of safety, but limited experience in the safety profession. These SPs are still in need of training and may work more closely with other SPs as they hone their skills. These SPs may engage in networking with friends, family, classmates, coworkers, and others.</td>
</tr>
<tr>
<td><strong>B)</strong></td>
<td>These SPs tend to have the authority to work independently or with little supervision. They may be tasked to implement programs and policies with senior approval. At this stage of their career, these SPs tend to lean away from social networking in favor of professional networking. SPs at this level may remain at this level of responsibility for an extended period, and possibly conclude their career at this stage. This may be due to a preference for remaining active in the safety profession in lieu of taking on a more conventional role as supervising manager.</td>
</tr>
<tr>
<td><strong>C)</strong></td>
<td>SPs at this level, may or may not supervise many mid-career and entry level SPs. SPs at this level tend to be responsible for setting department and organizational goals and policy. These SPs make it a point to attend training for the purpose of maintaining skills rather than learning new skills. These SPs will have an extensive network of colleagues in a variety of professions. Additionally, these SPs are often sought after for knowledge and expertise in a particular subject or subjects. These SPs may work alone or collaboratively.</td>
</tr>
</tbody>
</table>
December 20, 2016

Jarred O’Dell
415 Moffett Street
Watertown, NY 13601

Dear Mr. O’Dell:

Your proposed research project, "Measuring the Knowledge, Skills, and Abilities of Safety and Health Professionals," (Log No. 16-312) has been reviewed by the IRB and is approved. In accordance with 45CFR46.101 and IUP Policy, your project is exempt from continuing review. This approval does not supersede or obviate compliance with any other University requirements, including, but not limited to, enrollment, degree completion deadlines, topic approval, and conduct of university-affiliated activities.

You should read all of this letter, as it contains important information about conducting your study.

Now that your project has been approved by the IRB, there are elements of the Federal Regulations to which you must attend. IUP adheres to these regulations strictly:

1. You must conduct your study exactly as it was approved by the IRB.
2. Any additions or changes in procedures must be approved by the IRB before they are implemented.
3. You must notify the IRB promptly of any events that affect the safety or well-being of subjects.
4. You must notify the IRB promptly of any modifications of your study or other responses that are necessitated by any events reported in Items 2 or 3.

The IRB may review or audit your project at random or for cause. In accordance with IUP Policy and Federal Regulation (45CFR46.113), the Board may suspend or terminate your project if your project has not been conducted as approved or if other difficulties are detected.

Although your human subjects review process is complete, the School of Graduate Studies and Research requires submission and approval of a Research
IRB to Jarred O'Dell, December 20, 2016

Topic Approval Form (RTAF) before you can begin your research. If you have not yet submitted your RTAF, the form can be found at http://www.iup.edu/page.aspx?id=91683.

While not under the purview of the IRB, researchers are responsible for adhering to US copyright law when using existing scales, survey items, or other works in the conduct of research. Information regarding copyright law and compliance at IUP, including links to sample permission request letters, can be found at http://www.iup.edu/page.aspx?id=165526.

I wish you success as you pursue this important endeavor.

Sincerely,

Jennifer Roberts, Ph.D.
Chairperson, Institutional Review Board for the Protection of Human Subjects
Professor of Criminology

JLR:jeb

Cc: Dr. Majed Zreiqat, Thesis Advisor
    Ms. Brenda Bcal, Secretary
Appendix D
CITI Training Documentation

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- Name: Jared O'Dell, CSP, CSIP (ID: 5012072)
- Institution Affiliation: Indiana University of Pennsylvania (ID: 1711)
- Institution Unit: Safety Sciences
- Curriculum Group: Human Subjects Research
- Course Learner Group: Social, Behavioral, Educational, Researchers
- Stage: Stage 1 - Basic Course

- Report ID: 17096495
- Completion Date: 06/26/2015
- Expiration Date: N/A
- Minimum Passing: 80
- Reported Score*: 91

### REQUIRED AND ELECTIVE MODULES ONLY

<table>
<thead>
<tr>
<th>Module</th>
<th>Date Completed</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>History and Ethical Principles - SBE (ID: 490)</td>
<td>09/25/15</td>
<td>45 (80%)</td>
</tr>
<tr>
<td>Defining Research with Human Subjects - SBE (ID: 491)</td>
<td>09/25/15</td>
<td>45 (80%)</td>
</tr>
<tr>
<td>The Federal Regulations - SBE (ID: 502)</td>
<td>09/25/15</td>
<td>55 (100%)</td>
</tr>
<tr>
<td>Assessing Risk - SBE (ID: 503)</td>
<td>09/25/15</td>
<td>55 (100%)</td>
</tr>
<tr>
<td>Informed Consent - SBE (ID: 504)</td>
<td>09/25/15</td>
<td>55 (100%)</td>
</tr>
<tr>
<td>Privacy and Confidentiality - SBE (ID: 505)</td>
<td>09/25/15</td>
<td>55 (100%)</td>
</tr>
<tr>
<td>Belmont Report and CITI Course Introduction (ID: 1127)</td>
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<td>35 (100%)</td>
</tr>
<tr>
<td>Conflicts of Interest in Research Involving Human Subjects (ID: 409)</td>
<td>09/25/15</td>
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</tr>
<tr>
<td>Vulnerable Subjects - Research Involving Workers/Employees (ID: 402)</td>
<td>09/25/15</td>
<td>44 (100%)</td>
</tr>
<tr>
<td>Students in Research (ID: 1321)</td>
<td>09/25/15</td>
<td>8/10 (80%)</td>
</tr>
<tr>
<td>Unanticipated Problems and Reporting Requirements in Social and Behavioral Research (ID: 14928)</td>
<td>09/25/15</td>
<td>45 (80%)</td>
</tr>
</tbody>
</table>

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution. Identified above or have been a paid independent learner.

CITI Program
Email: support@citiprogram.org
Phone: 305-243-7870
Web: https://www.citiprogram.org
COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- Name: Jared O'Dell, CSP, CUSP (ID: 5012072)
- Institution Affiliation: Indiana University of Pennsylvania (ID: 1711)
- Institution Unit: Safety Sciences
- Curriculum Group: Human Subjects Research
- Course Learner Group: Social, Behavioral, Educational Researchers
- Stage: Stage 1 - Basic Course
- Report ID: 17065496
- Report Date: 09/29/2015
- Current Score**: 91

<table>
<thead>
<tr>
<th>REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES</th>
<th>MOST RECENT</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students in Research (ID: 1321)</td>
<td>09/29/15</td>
<td>81/10 (90%)</td>
</tr>
<tr>
<td>History and Ethical Principles - SBE (ID: 400)</td>
<td>09/29/15</td>
<td>45/45 (100%)</td>
</tr>
<tr>
<td>Defining Research with Human Subjects - SBE (ID: 491)</td>
<td>09/29/15</td>
<td>45/45 (100%)</td>
</tr>
<tr>
<td>Belmont Report and CITI Course Introduction (ID: 1127)</td>
<td>09/29/15</td>
<td>30/30 (100%)</td>
</tr>
<tr>
<td>The Federal Regulations - SBE (ID: 502)</td>
<td>09/29/15</td>
<td>55/55 (100%)</td>
</tr>
<tr>
<td>Assessing Risk - SBE (ID: 503)</td>
<td>09/29/15</td>
<td>55/55 (100%)</td>
</tr>
<tr>
<td>Informed Consent - SBE (ID: 504)</td>
<td>09/29/15</td>
<td>55/55 (100%)</td>
</tr>
<tr>
<td>Privacy and Confidentiality - SBE (ID: 505)</td>
<td>09/29/15</td>
<td>55/55 (100%)</td>
</tr>
<tr>
<td>Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)</td>
<td>09/29/15</td>
<td>4/4 (100%)</td>
</tr>
<tr>
<td>Unanticipated Problems and Reporting Requirements in Social and Behavioral Research (ID: 14028)</td>
<td>09/29/15</td>
<td>45/45 (90%)</td>
</tr>
<tr>
<td>Conflicts of Interest in Research Involving Human Subjects (ID: 488)</td>
<td>09/29/15</td>
<td>55/55 (100%)</td>
</tr>
</tbody>
</table>

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid independent learner.

CITI Program
Email: support@citiprograms.org
Phone: 305-243-7970
Web: https://www.citiprograms.org
Appendix E  
Applied Skills Rating by Career Stage

Table 4  
**Applied Skills Rating by Career Stage**

<table>
<thead>
<tr>
<th>Applied Skill</th>
<th>Entry-Level mean rating</th>
<th>Mid-Level mean rating</th>
<th>Senior-Level mean rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Science (Including fire protection and prevention)</td>
<td>4.46</td>
<td>5.76</td>
<td>6.59</td>
</tr>
<tr>
<td>Industrial Hygiene</td>
<td>4.49</td>
<td>5.76</td>
<td>6.78</td>
</tr>
<tr>
<td>Accident Investigation / Incident Analysis</td>
<td>5.79</td>
<td>7.27</td>
<td>7.98</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>4.74</td>
<td>5.93*</td>
<td>6.87</td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td>5.19*</td>
<td>6.39*</td>
<td>7.03*</td>
</tr>
<tr>
<td>Adult Education / Training – Management (e.g. needs assessment)</td>
<td>4.24</td>
<td>6.41*</td>
<td>7.42</td>
</tr>
<tr>
<td>Adult Education / Training – Technical (e.g. delivering presentation)</td>
<td>4.66</td>
<td>6.76</td>
<td>7.56</td>
</tr>
<tr>
<td>Safety and Health – Management (e.g. policy development &amp; trending)</td>
<td>4.37</td>
<td>6.82</td>
<td>8.15</td>
</tr>
<tr>
<td>Safety and Health – Technical (enforcement, monitoring, reporting)</td>
<td>5.49</td>
<td>6.98</td>
<td>7.83</td>
</tr>
<tr>
<td>Lines of Insurance (general/professional liability, workers’ comp, etc.)</td>
<td>3.60*</td>
<td>5.81*</td>
<td>7.23*</td>
</tr>
<tr>
<td>Regulatory Compliance for applicable enforcement agencies</td>
<td>5.57</td>
<td>7.14</td>
<td>7.87</td>
</tr>
<tr>
<td>Risk Assessment / Hazard Identification and Control methods</td>
<td>5.94</td>
<td>7.38</td>
<td>8.10</td>
</tr>
<tr>
<td>Emergency Preparedness and Response</td>
<td>5.26</td>
<td>6.71</td>
<td>7.58</td>
</tr>
</tbody>
</table>

*Indicates lack of correlation significance (α at 0.05) from Kruskal-Wallis H test.