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OSH Certifications: Behind the Exams

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In Brief

- The process for developing and scoring a certification exam is complicated and uses a scientific and mathematical psychometric process to achieve defendable outcomes.

- However, how much of the process is well understood by either the general public, employers or even safety and health professionals?

- The information presented is intended to help the safety and health professional understand why and how a properly developed and administered certification exam shows the mark of excellence in the field of safety and health.

How, Exactly, are Competency Certification Exams Developed and Scored?

Introduction

Occupational safety and health (OSH) professionals inherently understand the value of holding certification credentials such as the Certified Safety Professional (CSP), Canadian Registered Safety Professional (CRSP), and Certified Industrial Hygienist (CIH), but knowledge about how the certification program is established and maintained may not be as prevalent. OSH professionals might also have questions about the process, such as who determines what topics go on the exam? How are questions written and approved for inclusion on the exam? How are passing scores determined? A great deal of science and mathematics is behind the process. It is the intent of this article to answer these questions and help explain why and how a properly developed and administered certification examination shows the mark of excellence in the field of safety and health.

Certification vs. Certificate Program

To understand the certification process, it is first important to understand the difference between certification and a certificate program. Professional certification is defined by the Institute for Credentialing Excellence (ICE) as a "voluntary process by which a non-governmental entity grants a time-limited recognition and use of a credential to an individual after verifying that he or she has met predetermined and standardized criteria" (Knapp et al., 2006, p. 6). It is a process based on existing legal and psychometric requirements by which individuals who have demonstrated a specific level of knowledge and/or skill required by a profession are identified to the public and other stakeholders (Knapp et al., 2006, p. 6). Certification programs evaluate professionals against an established industry standard set through a defensible process (often called a job task analysis or role delineation process) resulting in the establishment of appropriate benchmarks of required knowledge and skills (Wright et al., 2015). The certification award is given for a specified duration

with required continuing professional development reported on a set cycle (Wright et al., 2015). If a certificant does not fulfill the required maintenance activities, the certification award expires.

In contrast, a certificate program generally results from attendance or participation in a particular course, successful demonstration of achieving the course objectives may or may not be required, and if assessment is performed, the evaluation method is typically not set through a formal standard setting process but instead are established by the program (Knapp et al., 2006; Wright et al., 2015. In addition, no continuing professional development is required to maintain the certificate (Wright et al., 2015) and there is no expiration on the awarded certificate.

Value of Certification

Certification programs are processes that identify individuals that are "qualified in a profession, occupation, role or skill" (Knapp et al., 2006). Certification programs raise the bar within a profession because they provide a benchmark of professionalism (Wright et al., 2015). Accredited certification programs, such as those accredited by organizations such as the American National Standards Institute or the National Commission for Certifying Agencies, provide professionals, employers, consumers, and government agencies an assurance of competency (Wright et al., 2015). Research has shown that in some fields, hiring managers may view holding a certification credential as "a more objective measure of a candidate's skill level than self-reported skills and competency" (Microsoft Corporation, 2007, p. 2). Requiring an applicant to hold a specified certification allows an employer to easily screen for those candidates that meet a specified education, experience, and competency level.

Organizations that use the services of professionals that hold BCSP certifications reported benefits including:

- improved competence in safety decisions,
- improved quality of safety inspections and audits,
- improved trust and confidence from clients in the ability to manage safety at job sites, and

- continued professional development through the required certification process. (Wright et al., 2015, p. 2)

A research study on the perceived value of certification among OSH professionals conducted for the Board of Canadian Registered Safety Professionals (BCRSP) identified that certification:

- is an indication of professional growth,

- enhances professional credibility,

- provides evidence of professional commitment,

- enhances employability and mobility, and

- increases earning potential. (Assessment Strategies Inc., 2011; Wright et al., 2015)

The increased earning potential of certified professionals is also supported through salary survey data collected by the BCSP, the American Board of Industrial Hygiene (ABIH), ASSE, the American Industrial Hygiene Association (AIHA), the Alliance of Hazardous Materials Professionals (AHMP), and the Institute of Hazardous Materials Management (IHMM) (BCSP, 2015a). The survey confirmed that employers recognize the value of certification and reflect this value through increased salaries and/or promotions (Wright et al., 2015). However, how many certificants or employers really understand how the certification process and exam are created and implemented?

Standard Setting & Examination Development

When developing certification examinations, a quality credentialing program must follow logically sound and legally defensible procedures (Wright et al., 2015). The BCSP, BCRSP and ABIH credentialing programs are accredited to the International Organization for Standardization and International Electrotechnical Commission (ISO/IEC) 17024 standard entitled "Conformity Assessment – General Requirements for Bodies Operating Certification of Persons," which provides "a global benchmark for personnel certification programmes to ensure that they operate in a consistent, comparable and reliable manner worldwide, thereby allowing individuals to have skills that translate across national lines" (Gasiorowski-Denis, 2012, para. 2). In the United States, the

certification of OSH professionals through the use of a standardized assessment tool, such as a multiple choice examination, has been the industry standard for more than 40 years (Wright et al., 2015). Standardized tests ensure a consistent method of scoring and facilitates legal defensibility (Wright et al., 2015).

Developing and administering the standardized test is done through what is called a **psychometric** process. The study of psychometrics is defined by Merriam-Webster as "a branch of clinical or applied psychology dealing with the use and application of mental measurement" ("Psychometrics," 2016), but basically, the psychometric process consists of a systematic method of establishing and delivering a quality certification examination measurement tool that will objectively measure the skills and knowledge of the individuals being assessed. The psychrometric examination development process includes the following steps.

- Job Task Analysis/Role Delineation

- Validation Survey

- Item Development

- Cut Score Determination

- Statistical Analysis

- Continuous Improvement (Wright et al., 2015)

Job Task Analysis/Role Delineation

Before an examination is developed, the critical knowledge and skills to be tested must be established (Wright et al., 2015). This process is known as the job task analysis or role delineation process, and is usually performed by a group of representative (e.g., geographically, industry and demographically dispersed) subject matter experts (SMEs) who have already achieved the particular certification under review (Wright et al., 2015). These SMEs review and/or determine domains of tasks, knowledge and skills required to practice in a field (Wright et al., 2015) and create a list of tasks that may be performed as part of the certificant's job as well as a list of knowledge and skills that may be needed to perform the job under each of the identified domains. To ensure that the

competencies identified as critical to practice within the certification are reflective of current practices, this job task analysis/role delineation process is undertaken at least every five years by the BCSP and BCRSP (Wright et al., 2015). This periodic review allows for knowledge of new scientific and technological advances in the profession to be incorporated and evaluated for potential candidates.

Validation Survey

The next step in the examination development process is the validation survey which uses another representative sample of SMEs to review and validate the outcome from the job task analysis/role delineation panel (Wright et al., 2015). This is typically conducted by survey in which the SMEs rate the importance, criticality and frequency of use of each task or skill identified in the job task analysis (Wright et al., 2015). The results of this validation survey are used to provide the framework for the examination structure (Wright et al., 2015). For example, if the survey reveals that a particular task, such as "participate in incident investigations using recognized techniques to prevent reoccurrence of workplace incidents" is identified by the SMEs as both an important and frequent task for the potential candidate to have at certification, then questions designed to measure that knowledge or skill of a candidate will be included on the examination.

The results of the job task analysis/role delineation and validation process are compiled into what is called an **examination blueprint**, which typically provides information on domains and competencies that may be tested (Wright et al., 2015) as well as how many items or questions should come from each domain and knowledge/skills area. The final blueprint is then approved by the appropriate Board or committee authorized to do so (Wright et al., 2015). These blueprints are published (ABIH, 2015; BCSP, 2015b; BCRSP, 2014) for potential candidates or employers to review to understand the competencies required of successful candidates, and to provide an outline of topics and concepts to review when preparing for the examination.

Examination and Item Development

Once the competencies to be tested have been finalized, and the structure of the examination has been determined, the certification examination can be developed. "**Items**," or potential test questions for the examination, are developed to evaluate the candidate's ability to meet a particular knowledge or skill requirement identified on the blueprint. The item development process is designed to develop test questions that are fair and are representative of current and relevant industry practice for the profession (Wright et al., 2015; BCSP, n.d.-a). Another group of SMEs who hold the certification for which the items are being developed are gathered together and trained on the process. Items are written by these SMEs utilizing applicable globally-recognized resources and references, and the reference source of the information in the test question is documented for each item (Wright et al., 2015). Items undergo multiple levels of review to confirm that the item is relevant to the profession and certification, grammatically correct, applicable to a global audience, and linked to the examination blueprint (Wright et al., 2015). The test question answers must all be of similar length and must contain one correct or best alternative and credible "distractors," that are possible, but not quite the best alternative solution.

Before the item is used for scoring on an exam, it must go through a beta testing process to be sure it appropriately meets certain criteria to appropriately evaluate the candidate's knowledge or skills. During this beta testing phase, items that are too easy (e.g., more than 80% of the candidates answer it correctly), and items that are too hard (e.g., less than 40% of the candidates answer correctly) are tagged for revision or removal. By eliminating both the very easy and the very hard questions, those questions that remain are those that can truly differentiate between the minimally qualified candidate and those that are not qualified to hold the credential. This is important in understanding why the cut score, discussed next, appears to the general public to be a relatively low passing score (usually below 70%). When all the questions that every, or most, candidates would answer correctly are removed, the overall score will be lower than a typical academic-style examination.
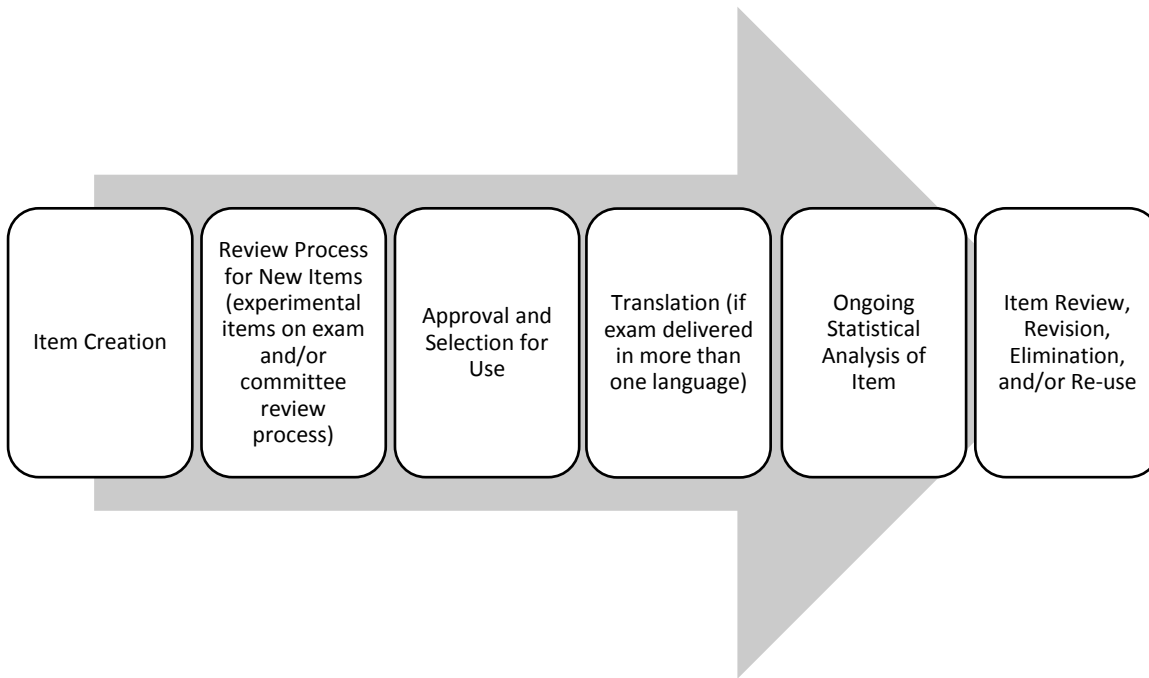
Figure 1. Item development process. Adapted from "Certification of OSH Professionals through an Accredited Competency Assessment Model," by Wright et al., *Proceedings Book of the WOS 8th International Conference,* p. 4

Cut Score Determination

The goal of a certification exam is to determine whether a candidate has the minimum knowledge and skills to be considered competent, and this is done by whether or not the candidate's score on the exam meets or exceeds what is called the cut score, or passing, score, for the exam (BCSP, n.d.-a). A common and generally accepted best practice for setting the cut score for certification examinations is to use the Angoff Method or Modified Angoff Method (Wright et al., 2015; BCSP, n.d.-a). Using these methods, the process begins with a panel of representative SMEs that are provided information on the Modified Angoff process, the purpose of a cut score, and the definitions and roles of a "not acceptable," "minimally acceptable," and "superior" candidate profiles for the exam (Young, 2015). A common understanding of the experience level and expectations of the minimally acceptable candidate, which is the target audience for the examination, is critical because the process involves the SME's evaluation of what percentage of these minimally qualified candidates would be expected to know the answer (BCSP, n.d.-a). This process takes into consideration difficulty and whether or not there would be a universal application of the knowledge or skill across all job settings (BCSP, n.d.-a).

SMEs are trained this Angoff rating process by first using individual test items. Participants are asked to read the test item, identify the correct answer, review the distractors, and provide an Angoff rating in terms of the SME's estimate of the percentage of minimally acceptable candidates that would correctly answer the item (Young, 2015). The SME ratings are evaluated, and if ratings among the SMEs show too much variation (e.g., the ratings exceeded a 30-point spread or standard deviation of 0.10), the SMEs with high and low Angoff ratings are asked to share the rationales for their ratings so that the group may discuss the differences in opinions (Young, 2015). Then, the SMEs are given an opportunity to adjust their initial Angoff ratings and this process is repeated until SMEs are consistently making Angoff ratings with little variation (e.g., a 30-point spread or less or standard deviation of 0.10 or less) (Young, 2015). Finally, the SMEs provide an Angoff rating for all the scored items on the particular examination being evaluated and an Angoff cut score (i.e., a tentative cut score) is calculated from these values by a psychometrician (Young, 2015). Based on the calculated cut score and data from previously administered exams, an appropriate cut score is set and this final pass mark for the examination is then approved by the Board or a committee authorized to do so (Wright et al., 2015). This complicated method results in a pass mark that is reflective of current, relevant, and applicable knowledge and skills established through a peer review process.
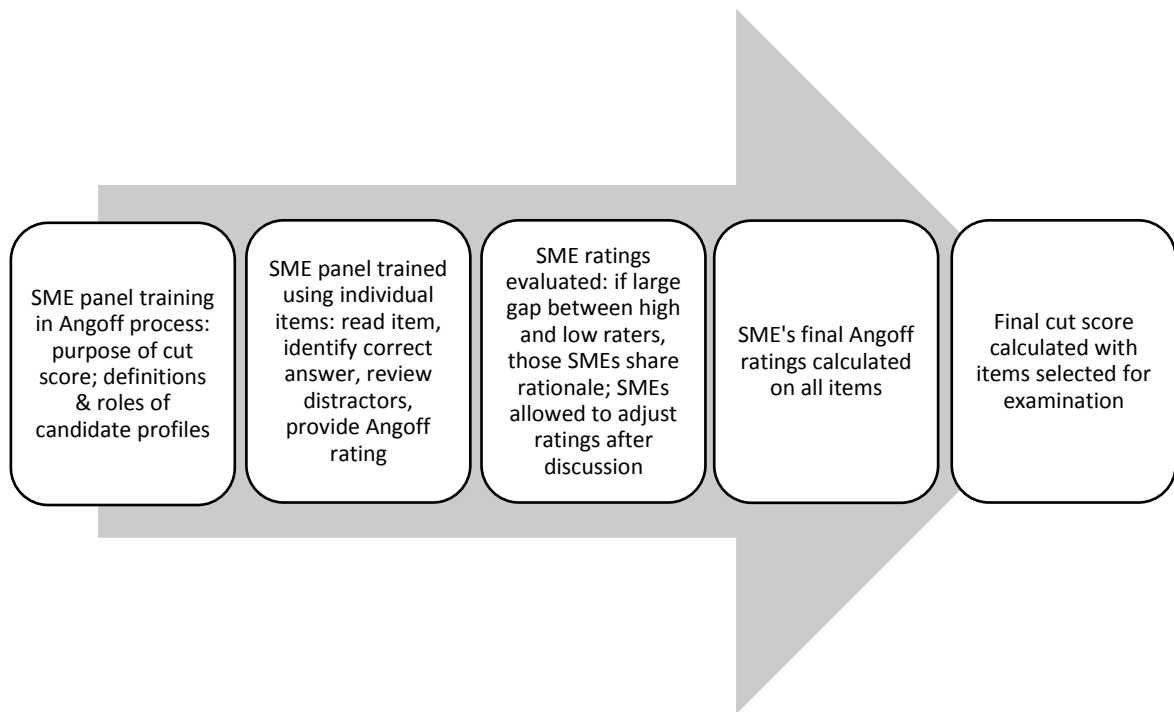
Figure 1. Cut score determination process using Angoff ratings.

Statistical Analysis

Statistical analysis of the exam as a whole and each individual test item provides a benchmark of the overall performance of a certification examination (Wright, et al., 2015). An annual statistical report is developed by a psychometrician to provide information on the reliability and validity of the examination forms, item bank statistics, program activities/initiatives undertaken towards process improvement, recommendations based on industry best practices, etc. (Wright et al., 2015). The methodology for reliability and validity of assessment is a key component within the ISO/IEC 17024 Standard, as stated in clause 9.3.5 that, "appropriate methodology and procedures shall be documented and implemented in order to reaffirm, at justified defined intervals, the fairness, validity, reliability and general performance of each examination, and that all identified deficiencies are corrected" (ISO/IEC, 2012). The ISO/IEC 17024 Standard defines **reliability** as an "indicator of the extent to which examination scores are consistent across different examination times and locations" and **validity** is defined as "evidence that the assessment measures what it is intended to measure, as defined by the certification scheme" (ISO/IEC, 2012). The BCSP, BCRSP, and ABIH all produce annual reports that provide information on the measurement of the validity

and reliability of their respective certification examinations (BCSP n.d.-b; Assessment Strategies Inc., 2014a; Assessment Strategies Inc.; 2014b; ABIH, n.d.) providing assurance to the candidates and the public that the certification meets the highest quality standards.

Continuous Improvement

The certifying body works in a continuous improvement mode to regularly monitor, measure, and analyze each step, including established standardized review periods for the examination blueprint, ongoing item bank development and maintenance, and policy review (Wright et al., 2015). For example, the BCSP and BCRSP review and update the ASP, CSP and CSRP blueprints at least every five years to ensure that the certification reflects current professional requirements and practices (Wright et al., 2015). Certification bodies may also benchmark their policies and procedures to other similar organizations and/or certification industry best practices as published by organizations such as ICE or the Association of Test Publishers (ATP) (Wright et al., 2015). The certification programs as a whole may also be evaluated and accredited by third-party agencies such as the National Commission for Certifying Agencies (NCCA) and the American National Standards Institute (ANSI) to evaluate whether the process meets the ISO 17024 standard or other national or international standard for certification (BCSP, n.d.-a). These continuous improvement and external review processes ensure that the certification is relevant, reliable, valid, and defensible.

Conclusion

In both the United States and Canada, certification is often used by employers, recruiters, and clients as a minimum qualification for OSH professional positions, and in fact, some research suggests that up to 70% of career advertisements for OSH professionals require or prefer a certified professional (Wright et al., 2015). Employers may well view that the individuals holding these certification credentials have proven their expertise in the OSH field by demonstrating competency through the certification process, are committed to the continuous learning process, and are governed by a Code of Ethics (Wright et al., 2015). However, the certification process is not often

understood by either the employer or those holding the certification. Knowing and understanding that the process is methodical, reliable, statistical, and validated is an important component of the value of the certification, and it shows that it is the mark of excellence in the field of safety and health.

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