WATER PROFESSIONALS INTERNATIONAL

The Associated Boards
of Certification

VALIDATING YOUR CERTIFICATION EXAM

Superior Water Starts Here™

Preface

The need to validate exams has always existed, but new regulations covering water treatment plant and distribution operators are making validation mandatory. Similar requirements for wastewater examination validation are under consideration.

Water Professionals International (WPI) has been validating water and wastewater treatment, distribution, collection, and laboratory analyst exams for nearly 30 years. WPI offers our experience in exam validation to our members who are attempting to determine the status of their exam validation procedures.

WPI exam validation services include:

1. Evaluating a member's existing program to determine the program's level of validation and to identify additional validation procedures that may be required.

2. Carrying out the full exam validation procedures outlined in this pamphlet, including conducting job analyses, linking items to the need-to-know criteria, coordinating item reviews, and conducting exam and cut score workshops for members.

3. Offering validated exams in water treatment, distribution, very small water systems, wastewater treatment, collection, and laboratory analysis. WPI's exams consist of questions that have gone through an extensive validation process. Each question is also reviewed during an exam development workshop prior to becoming part of an exam, and the performance of each question is monitored throughout the year by WPI. Twenty percent of WPI's item bank is reviewed each year, and a full job analysis for each certification category is conducted every five years.

Please contact WPI if you would like additional information about the exam validation options available through WPI.

Introduction

When testing has an impact on the livelihood of a candidate seeking a license to practice, the importance of ensuring a fair and accurate measurement process cannot be overstated. The US Equal Employment Opportunity Commission's *Guidelines on Employee Selection Procedures*[1] require evidence that tests are related to the work to be performed, and the US Supreme Court has held that tests must be "a reasonable measure of job performance."[2] There are prescribed steps in linking the relatedness of the exam to the knowledge and skills required for a job. These steps lead to an exam that has been "validated" in that its content accurately measures the knowledge and skill required for the job.[2]

The question of whether a certification exam is valid cannot be answered with a simple "yes" or "no." However, a psychometrician might give the following answer. "Our exams have been developed using the appropriate methods to ensure they contain content that fairly reflects the knowledge and critical abilities required to effectively perform the jobs necessary for a particular class of operator or laboratory analyst." Stated more simply, the answer might merely be "Our exams adequately cover the defined scope of the job." To support this statement, the psychometrician must be prepared to provide evidence that the appropriate methods were followed to ensure that the exams are "valid" for the job for which the test has been developed.

To help its members achieve validated exams, WPI has prepared this summary of the processes involved in exam validation. This pamphlet is not intended to be a comprehensive treatment of validation procedures, but to serve as a brief summary document for the states and provinces as they evaluate their exam development procedures.

Why is validation important?

Using an examination as one measure to determine whether an individual can work as an operator or laboratory analyst requires some assurance that the exam is fair and accurate, especially when it can have an impact on the applicant's livelihood. Applicants "deserve to be tested on appropriate content that is relevant to the credential they are seeking. For the assessment to be appropriate, it must be related to competencies that are required for performance on the job or in the profession."[2]

Who decides whether an exam is valid?

The ultimate decision of whether or not an exam is valid will generally be made by the courts during litigation. Applicants who believe that the exam was unfair, biased, or did not address the critical abilities required for the job, and who have suffered financial or emotional impact due to the "unfair test," are most likely to challenge the examination process in court. The issue of whether or not the exam is valid will be debated with the final arbitrator being the court itself. The degree by which one can provide evidence of exam validation may play a pivotal role in the final outcome of the lawsuit.

To document validity of a certification exam, three assumptions are important:[2]

1. That there are certain critical abilities necessary for effective performance, and that individuals who lack these abilities will not be able to perform adequately in practice.

2. That individuals scoring low on the exam lack knowledge underlying these critical abilities and will not be able to practice in a safe and effective manner.

3. That the exam can be designed to accurately identify the point at which the knowledge, skills, and abilities demonstrated on the examination are most indicative of the candidate's ability to practice in a safe and effective manner.

Steps in the Validation of an Exam

The validation of certification exams depends primarily on evidence that the content of the exam adequately represents the job (called content validity). Standards for validation have been published in the *Uniform Guidelines on Employee Selection Procedures*[1] by the United States government's Equal Employment Opportunity Commission and in the *Standards for Educational and Psychological Testing*.[3] These standards require a certification exam to focus on the level of knowledge, skills, and abilities necessary to assure the public that a person can competently perform the job. Passing the certification exam should mean the worker is able to perform his or her job without putting the safety and welfare of the public in danger.

Content validity is measured by the degree to which the items on the examination represent the range of knowledge and skills required to competently carry out the job. To meet the criteria for content validity, knowledge, skills, and abilities must be critically related to successful job performance. This link demonstrates that the certification exam measures the knowledge, skills, and abilities necessary to successfully perform the job.

It is essential to involve subject matter experts in all parts of the validation process. To qualify as a subject matter expert, a person must have direct, up-to-date experience with the job, sufficient to be familiar with all of the required tasks. Subject matter experts may include operators, supervisors, trainers, and other individuals with specialized knowledge about the job.

The principal steps normally taken for exam validation include:

1. Conduct a job analysis
2. Develop and validate items
3. Develop an exam
4. Establish a cut score

The chart on page 6 displays the sequence of steps that can be taken in validating your certification exam.

Step 1. Conduct a Job Analysis

Conducting a job analysis is an essential first step in establishing the content validity of certification exams. A job analysis is the process of identifying the critical components of a job that are necessary for successful performance. In addition, a job analysis often lists the capabilities (i.e., knowledge, skills, and abilities) required to perform work tasks.

In the case of certification, the identified work tasks and their associated capabilities must be related to the protection of the public.[3]

The first step in conducting a job analysis is to develop a broad outline of job activities. Many methods can be used to develop this outline, including observing work situations, interviewing operators, and analyzing job-related material. After an outline of the job activities is identified, specific job tasks may be determined.

Workshops are held to identify specific job tasks and capabilities required for successful job performance. During these workshops, subject matter experts verify that the task statements developed are technically correct, unambiguous, and accurately reflect the job. After reaching a consensus that the task statements are adequate, the subject matter experts identify the capabilities required to perform the job tasks. Identification of capabilities must be done on a task-by-task basis so that a link is established between each task statement and the requisite capability.
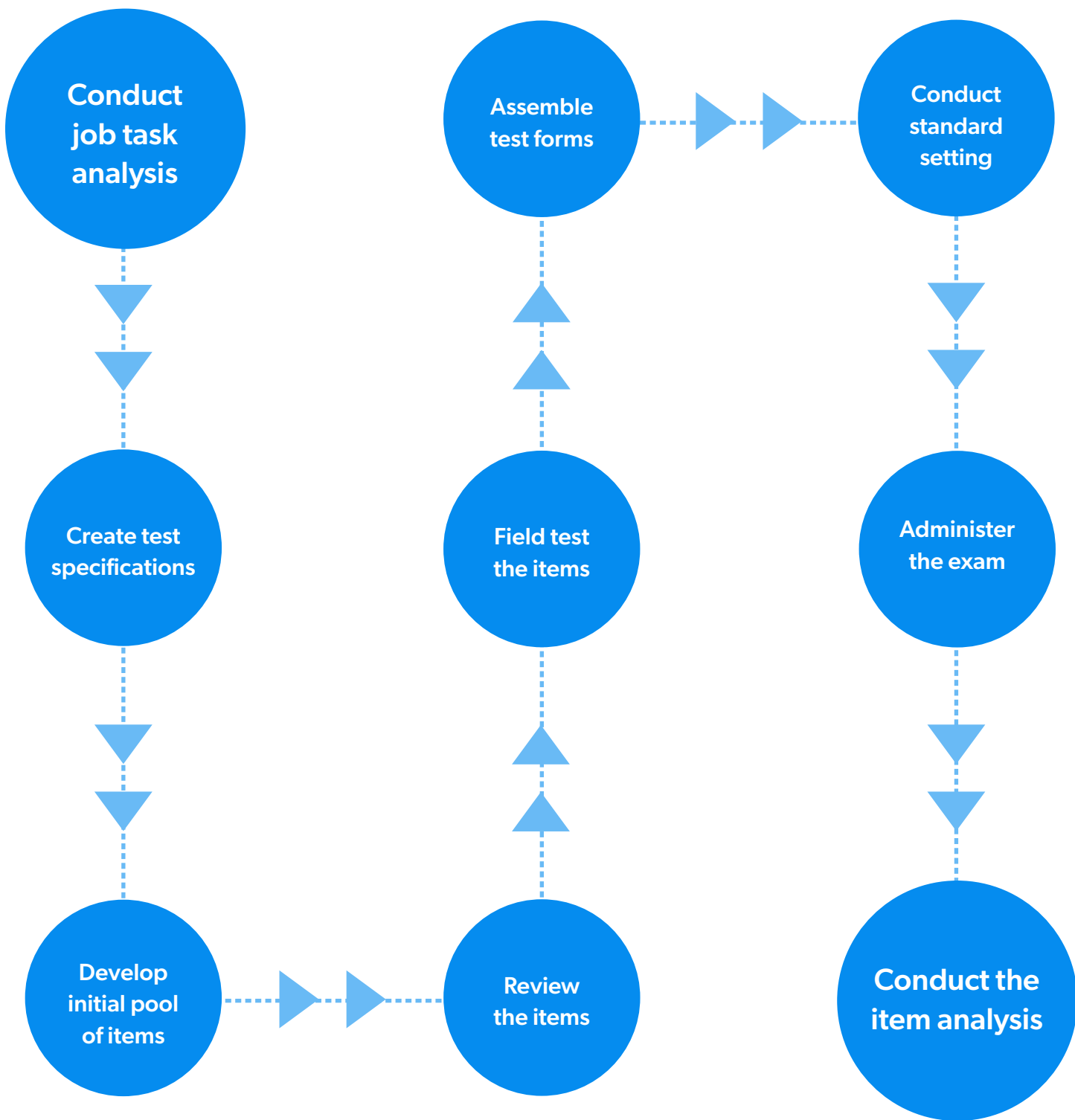
A survey is developed that includes the task statements and capabilities identified during the workshop. Given the purpose of certification—protection of the public—it is important to use rating scales that determine which tasks may result in harm to the public if not performed competently. In addition to potential-for-harm scales, frequency data is relevant to defining the content of certification exams. The survey is completed by operators in order to verify and collect data on the task list.

Data collected from the survey is analyzed to determine the most critical job tasks. The mean, standard deviation, and percentage of respondents performing each task statement are computed to determine the criticality of the job tasks.

Step 2. Develop and Validate Items

Exam items are developed from the results of the job analysis so that exams represent job tasks. Once the new items are written, they must go through a validation process, which includes:

A. Linking new questions to the results of the job analysis. The purpose of this step is to ensure that all questions on the certification exam measure at least one important aspect of an operator's job. During this process, subject matter experts rate the extent to which the questions reflect specific tasks in the job.

Conduct job task analysis

Create test specifications

Develop initial pool of items

Review the items

Field test the items

Assemble test forms

Conduct standard setting

Administer the exam

Conduct the item analysis

For example, the question "Which equipment is used when running a settleable solids test?" matches the task in WPI's job analysis "Perform and interpret laboratory analysis for settleable solids" and the capability "Knowledge of laboratory equipment and procedures."

B. Analyzing questions for technical accuracy, style, readability, and possible bias toward subgroups. Determine that the correct answer is the best answer, that the distractors (incorrect answers) are wrong, and that the question is free from bias with respect to race, gender, and culture.

C. Reviewing items for job importance. Importance ratings should reflect how well the question distinguishes between effective and ineffective job performance and whether the knowledge tested in the question is necessary for competent job performance. Importance ratings indicate how well each item reflects the competency by using a rating scale, such as:

0—No Match	**1—Poor**	**2—Fair**
3—Good	**4—Very Good**	**5—Excellent**

The continued relevance of questions that have been validated must be ensured through periodic reviews of the items by subject matter experts. Evaluation of questions should also be conducted through statistical analysis. Of particular importance are the difficulty index (the ratio of examinees who answer each question correctly) and the discrimination index (how well the question distinguishes between more knowledgeable and less knowledgeable examinees).

Step 3. Develop the Exam

After the job analysis survey is evaluated, the results are used to develop valid certification exams. Specifications for certification exams (i.e., the categories of required knowledge, such as safety, pumps, maintenance, administration, etc.) are based on the results of the job analysis and reflect how often a task, knowledge, skill, or ability is needed in practice and how much impact it has on effective job performance.[4]

Subject matter experts review and select the questions for the exam, often in a workshop setting. The questions are selected based on their statistical performance and how well they reflect the appropriate exam specifications that were identified by the job analysis.

Step 4. Establish the Cut Score

The cut score is defined as the minimum score required to pass an exam. Defining the cut score required for certification is one of the most important but difficult aspects of the validation process. The validity depends on whether the cut score accurately distinguishes between adequate and inadequate performance. Cut scores must be high enough to protect the public but not so high as to unnecessarily screen out qualified operators.

A cut score study is critical because it addresses the difficulty of individual questions on an exam.

For example, an exam with more difficult questions should have a lower cut score than an exam with easier questions. The cut score is determined by judgments about test questions. Subject matter experts are used to specify the level of performance that should be required on the exam. There are many methods of conducting a cut score study (e.g, Angoff, Ebel, and Nedelsky).[5] In order to be valid, a cut score study must be clearly documented and follow a structured process.

The following table is an example of the Angoff Method for 5 raters (A through E) and 10 items. Each rater (a subject matter expert) rates each of the 10 items. Their collective score for the 10 - question exam is averaged to obtain the single cut score for the exam. The cut score for the example below is 70.1%.

Rater					
Item	A	B	C	D	E
1	.90	.85	.80	.80	.85
2	.90	.90	.90	.90	.95
3	.80	.60	.60	.70	.70
4	.75	.70	.70	.80	.60
5	.80	.55	.60	.55	.60
6	.60	.70	.65	.65	.70
7	.55	.50	.55	.55	.50
8	.75	.70	.55	.75	.70
9	.80	.90	.80	.80	.75
10	.55	.65	.50	.45	.65
Rater Average	.740	.705	.665	.695	.700
Average Cut Score 70.1%					

References

US Equal Employment Opportunity Commission, 1978. Part 1607—"Uniform Guidelines on Employee Selection Procedures." *Federal Register*, Vol. 43, No. 166-August 25, 1978.

National Organization for Competency Assurance, 1996. *Certification, A NOCA Handbook*. Anne Browning, Alan Bugbee, Jr., and Meredith Mullins (eds), Washington, DC.

American Educational Research Association, American Psychological Association, and National Council on Measurement in Education, 1999. *Standards for Educational and Psychological Testing*. Washington, DC: American Educational Research Association.

Fortune, Jim, and Associates, 1985. *Understanding Testing in Occupational Licensing*. San Francisco: Jossey-Bass Inc.

Impara, James, 1995. *Licensure Testing: Purposes, Procedures, and Practices*. Lincoln, NE: Buros Institute of Mental Measurements.

Water Professionals International has been assisting states and provinces with environmental certification programs since 1972. From an initial charter membership of 25 certifying authorities, membership spans 49 U.S. states/territories, 12 Canadian provinces/territories, and many Canadian First Nations and U.S. tribal entities, as well as many Eastern European, Caribbean, and Middle Eastern countries/territories.

WPI Vision

Public Health and the Environment are Protected through Stewardship of Water Resources

WPI Mission

Competent Water & Wastewater Professionals in a Supportive Policy Environment

WPI's Organizational Strategies

Credentialing

WPI believes that competent operators are essential to the stewardship of water and wastewater resources and systems.

We will:

Increase the number of operators pursuing certification

Increase the number of certified operators

Increase the breadth of validated certifications across relevant water/wastewater disciplines

Advocacy

WPI is interested in developing and maintaining a competent workforce to support safe and effective water and wastewater systems.

We will:

Establish WPI PO certification as a partnered component of state/provincial licensure

Expand reciprocity of operator licensure across states/provinces

Increase public funding for operator workforce development, certification, and training