

STAGE 1

Defining Your Target
& Creating Test
Specifications

MEASURE
LEARNING

— Meazure Learning Whitepaper



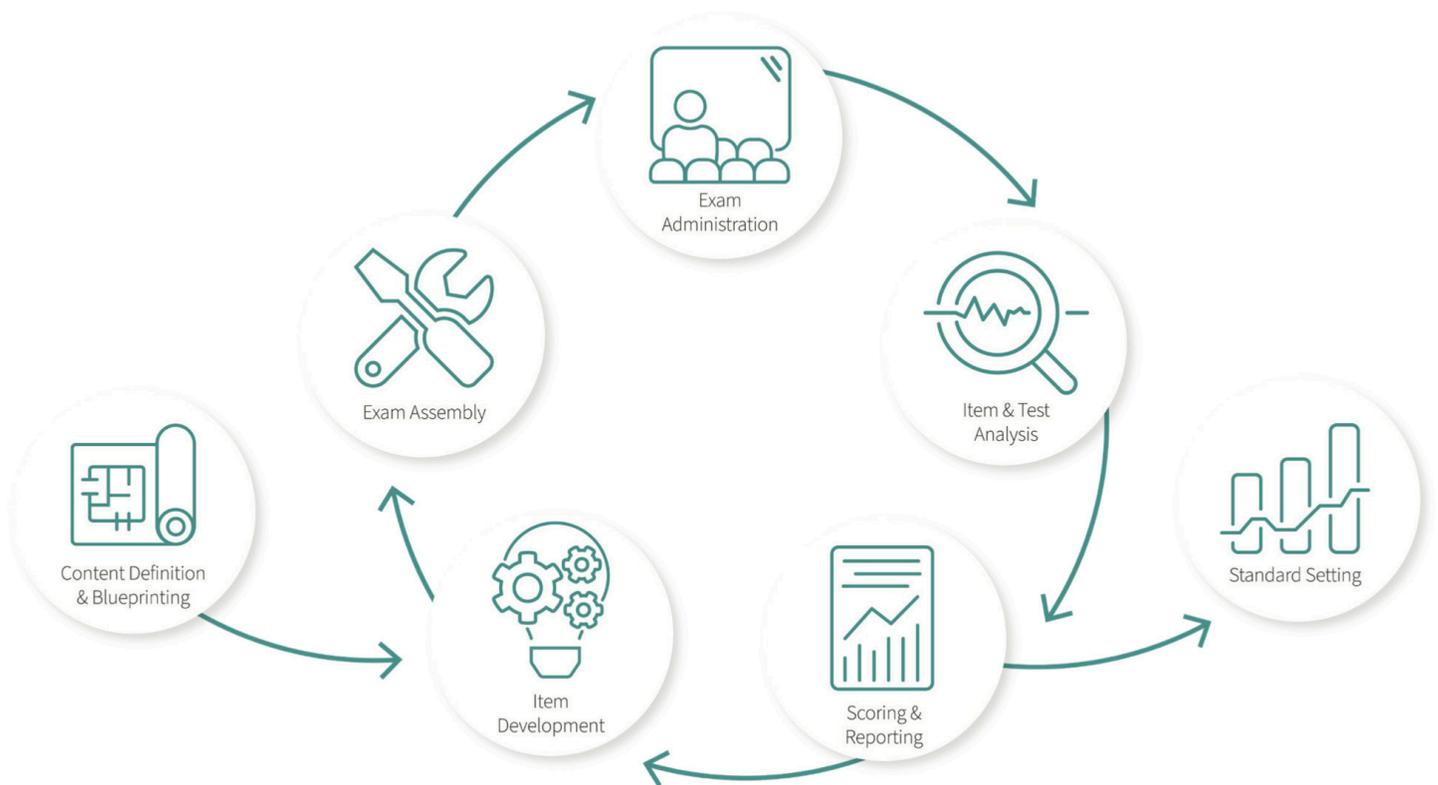


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Introduction

The Assessment Life Cycle is a way of organizing the processes involved in creating valid assessments into a series of easy-to-understand, logical stages.



Every assessment program starts with Defining targets and creating test specifications (Stage 1). During this stage, the test developers decide what the goal of their assessment is going to be. Stated more specifically, the test developers decide what conclusions they'd like to be able to make about their test-takers. These goals are then formalized and enshrined through the creation of an “examination blueprint”, which specifies the number and type of questions that the assessment will need to include in order to soundly measure test-takers in the correct subject area and at the correct level.

Even though we usually refer to this process as being one stage, there are actually two fairly major steps involved in going from the idea of an exam to actually having a full, workable examination blueprint, specifically:

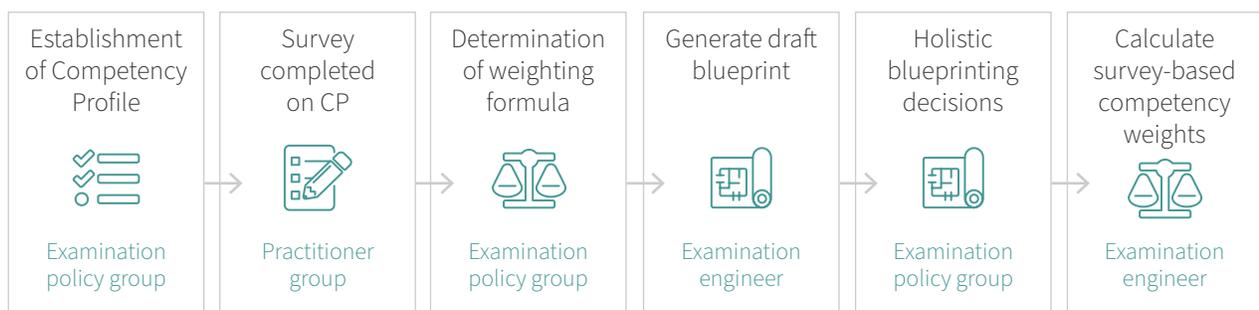
1. Defining the skills and knowledge that are required for competent and safe performance in the area being assessed (i.e., creating a competency profile).
2. Deciding on the test parameters (or specifications) that will result in a valid assessment of the skills and knowledge defined in the first step (i.e., creating an exam blueprint).

We could also further break this process down into a series of more specific tasks. Although these tasks may vary somewhat across different projects and fields, in general, the tasks involved in Stage 1 of the Assessment Life Cycle are as follows:

1. Creating a competency profile
2. Surveying practitioners in the field
3. Creating a weighting formula
4. Calculating competency weights
5. Making holistic examination blueprint decisions
6. Generating a draft examination blueprint

Below, you can see a graphical overview of these tasks (and who is primarily responsible for completing each of them):

PURPOSE & SPECIFICATIONS



Additional purpose and specifications for examination policy group:

- Competency representation
- “Other” representation
- Recouncillation of holistic and survey-based weights



1 | Establishing a Competency Profile

The success of any assessment program hinges on the effective identification of the knowledge and skills that test-takers will be measured on. It is critical to put in the time and effort required to develop a valid and thorough inventory of the skills and knowledge that make up the subject area being assessed. This can be a time-consuming and detailed-oriented process; but one that is vital to the success of the overall assessment program.

A competency profile (also referred to as a “competency model”, “job map”, or “job matrix”) for a given profession defines what a professional in that field should know and should be able to do within their job role. Often, a competency profile will not only specify which skills, knowledge, behaviors, or attitudes are required for mastery of the subject area; but will also specify how critical each of these qualities are for competent performance in that role.

On first read, this may sound somewhat abstract. If you’d like to see an example of a competency profile in action, here is one used by the College of Licensed Practical Nurses of Alberta (CLPNA). The introductory paragraph provides an excellent summary of the content of the competency profile, and how the competency profile should be used and interpreted:



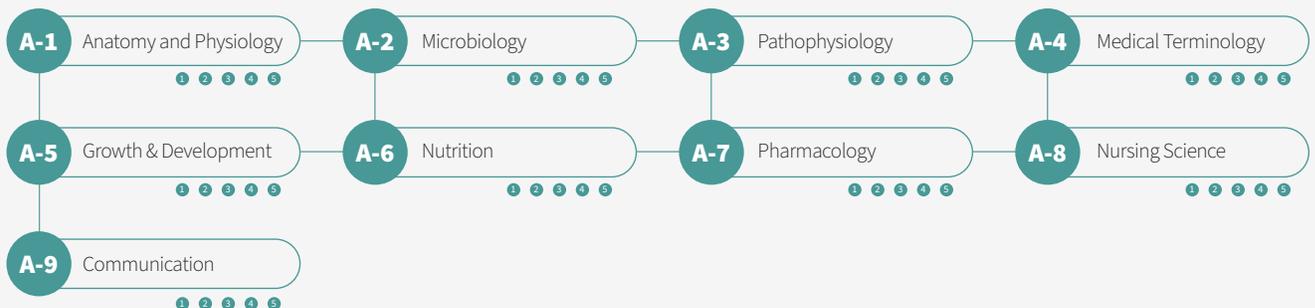
This Competency Profile includes the knowledge, skills, behaviours and attitudes required by a Licensed Practical Nurse (LPN) in Alberta as outlined in the Health Professions Act LPN Regulation 2003, and the CLPNA Standards of Practice. No one LPN is required to possess all competencies described in this document.

The competencies defined in the profile may be attained by LPNs in many different ways. Entry to practice/Basic competencies are acquired through formal practical nurse education. Additional competencies may be gained through informal and formal learning, experience, on-the-job training, post-basic education or certification. Specialty competencies are acquired through completion of approved programs and advanced certification.

In many cases, a competency profile will be organized into a number of “competency categories”. Specifically, competent performance in the job role is broken down into several high-level domain areas; and each of these areas is, in turn, broken down into a number of more specific sub-domains.

Returning to the LPN competency profile above, we can see that “Nursing Knowledge” represents one of the broader competency areas that is required for successful practice as an LPN. In itself, “Nursing Knowledge” is not particularly informative; but we can also see that it is made up of several sub-domains, including “Anatomy and Physiology” and “Microbiology”.

A. Nursing Knowledge



B. Nursing Process



By documenting these details, competency profiles serve as a sort of “road map” for understanding the breakdown of a given job. Not surprisingly, they can be quite involved. It is not uncommon for a competency profile to have 30 or more high-level competency areas; and each of these areas might have anywhere from two to 20 (or more) sub-domains (with a great deal of detail included for each of these). As a result, a full competency profile might be hundreds of pages in length.

To give you an idea of what this looks like in practice, here is an example of the details included in the “Anatomy and Physiology” sub-domain of the LPN competency profile:

MAJOR COMPETENCY AREA

A. Nursing Knowledge

Priority: One

Date: September 1, 2005

A-1 Anatomy and Physiology

1 2 3 4 5

A Licensed Practical Nurse will:

- A-1-1** Identify the normal structures and function of the body.
- A-1-2** Describe the anatomical organization of the body.
- A-1-3** Describe the cellular chemistry and organization of the body.
- A-1-4** Describe basic cellular functions — protein synthesis, cell division, and movement of substances across the cell membrane.
- A-1-5** Explain how cells are organized into tissue, organism and systems of the body.
- A-1-6** Identify the structure and explain the function of body systems:
 - cardiovascular system
 - circulatory system
 - digestive system
 - endocrine system
 - genitourinary system
 - immune system
 - integumentary system
 - lymphatic system
 - nervous system and special senses
 - reproductive system
 - respiratory system
- A-1-7** Identify the components of blood and blood products.
- A-1-8** Describe the major body processes of:
 - metabolism
 - reproduction
 - homeostasis

2 | Surveying Practitioners

Once a competency profile has been created, a representative group of practitioners in the field is often asked to take a survey to rate each of its constituent competencies (that is the knowledge, skills, behaviours, or attitudes that make up the profile). The goal of this survey is to establish a defensible rating of how “critical” each competency is.

Criticality is somewhat subjective in nature; and can be defined differently depending on the needs of the profession. Consequently, there are different ways to make the ratings for this. For example, in many health professions, subject matter experts provide two different kinds of ratings: frequency (i.e., how often the competency in question is required in the job role); and importance (i.e., the severity of negative consequences that result when the competency is performed incorrectly). For other professions and contexts, it is often enough to simply to ask practitioners how important each competency is for in-role performance (see below for an example):

How important is the correct performance of this competency to the sound lawful practice of a Licensed Practical Nurse in Alberta?

	NOT APPLICABLE	NOT IMPORTANT	SOMEWHAT IMPORTANT	IMPORTANT	VERY IMPORTANT
1.4.1 Standard of practice and Code of Ethics - Identification of the Code of Ethics and purpose.	<input type="radio"/>				
1.4.2 Standard of practice and Code of Ethics - Identification of the Six Standards and purpose.	<input type="radio"/>				
1.5.1 Protection of Title - Identify the title and or abbreviations, which can be used by regulated members of the profession.	<input type="radio"/>				
1.6.1 Continuing Competence - Identify the purpose of Continuing Competence Program.	<input type="radio"/>				
1.6.2 Continuing Competence - Choose the process used by CLPNA to review, evaluate a members continuing competence program.	<input type="radio"/>				
1.6.3 Continuing Competence - Identify the requirement to reflect upon actions to develop a learning plan to continuously improve knowledge and skills.	<input type="radio"/>				

It is important to remember that not every competency covered in a competency profile is actually something that can be assessed using a standard multiple-choice exam. For example, performance-based competencies are often better-suited to performance-based assessments (such as an Objective Structured Clinical Examination or “OSCE”, an assessment centre, or a roleplay assessment). Because of this, it is also valuable to use this stage to identify which competency areas are testable using a multiple-choice exam, and which might require a different approach to assessment altogether.



3 | Determining the Weighting Formula

As mentioned above, in some professions it is important to assess the criticality of each competency in the competency profile on more than one front (for example, “How frequently is this competency required”, and “How severe are the repercussions when this competency is not performed correctly?”). In order to derive an overall rating of criticality from this, an additional step is required. Specifically, subject matter experts in the field must also decide how to weight each different type of rating (e.g., “frequency”, “importance”); and then use these weighted scores to calculate each competency’s overall criticality.

This isn’t a decision to be made lightly. The weighting rule will decide which element of a competency is most important in determining the competency’s criticality (and how much more important that element is). This will change the eventual weighting that the competency is given on the examination. In order for these competency weightings to be valid, it is necessary to apply a thorough and well-considered process to any weighting formulas that are used.

To do this, one might recruit a group of key stakeholders or policy makers, who will serve as the examination policy group (see the diagram above). This group will then be tasked to: 1) determine which ‘dimension’ (e.g., frequency or importance) should be more heavily weighted in the calculation of criticality; and, 2) Select the weightings for each dimension that make the most sense, given the professional judgment of each of the participants in the policy group. These decisions can be made either by majority vote via a survey; or by reaching a consensus through discussion.

4 | Calculating Survey-based Competency Weights

Once the subject matter experts have completed their ratings of each competency in the competency profile and a weighting formula has been determined (if necessary), the next step is to calculate the weighting that each competency should be given on the actual examination. By tailoring the weighting of each competency to its criticality rating, the test developer is able to create an assessment that not only covers the breadth of subject area; but also one that prioritizes assessing its most important topics.

In addition to weighting individual competencies, one can also derive higher-level weights for the broader competency areas. The weights across all competencies are summed to define an exam total weight. This process is then repeated for all competencies across each individual competency area; which gives a total weight for that area. By dividing the weight per area by the exam total weight, one can derive a proportion of the examination for that area; which can serve as the expected weighting it will be given on the final examination.

Although we generally use a more direct process for the final determination of weights than the one described above, this calculation does provide an additional source of information that panelists may consider when setting final weights (covered in Step 5 of this process).

5 | Making Holistic Blueprinting Decisions

Once these weightings have been calculated, the examination policy group can move on to the next stage, which involves directly specifying the weightings for higher-level blueprint categories. As this process is fairly discussion-heavy, it is usually done in a face-to-face policy group meeting.

To begin this process, each panelist is given an independent survey that asks them how much weight they would give to each major ‘facet’ of the blueprint. These ‘facets’ include a number of things (e.g., the breakdown of competency areas, the type of questions that could be used).

Once this is done, a facilitator will search for any instances where the panelists’ independent survey judgments significantly differed; and flag these discrepancies for further group discussion. The facilitator will also review the competency area weightings that the panelists made; and compare these to the weightings that were derived mathematically in ‘Step 4’ of this process (flagging any instances where there

is a large discrepancy between the two weightings). Following a discussion on any discrepancies arising out of either source, the panelists are invited (but not required), to revisit their initial judgments.

These discussions are an integral part of the blueprinting process. In fact, in our experience, it is this opportunity to share different perspectives on professional practice that directly leads to greater satisfaction with the blueprinting process. The blueprint also improves; as through this discussion, the panelists often gain a ‘bigger picture’ view of the profession; and are subsequently in a better position to use their ratings to represent the profession as a whole.

6 | Generating a Draft Blueprint

Once these ratings are made, the test developer will have all the information they need to create a draft of the examination blueprint. Typically, this part of the process is accomplished by a psychometrician; and is based on the compilation of the panelists’ judgments from ‘Step 4’ and ‘Step 5’.

The examination blueprint breaks down how many questions on the assessment should relate to each specific competency and competency area; as well as how many questions should be of a particular type (for example, the number of knowledge-based questions versus the number of questions that ask candidates to apply that knowledge to a novel situation). This could result in a breakdown like the one shown below:

Area	Knowledge	Application	Weighting
I	12	25	37%
II	4	4	8%
III	4	1	5%
IV	15	5	20%
V	25	5	30%
TOTAL	60%	40%	100%

As you can see, each area has an associated weighting; and these weightings are broken down into the rough number of questions that assess recalling knowledge versus applying knowledge. This is only meant as a simple example. A full competency profile draft would likely go further than this one; and could also break the weightings down by specific competencies within each category.

Note that, at this stage, the blueprint is still just a draft. Clients will often want to take the draft blueprint back to the practitioner community to receive a final validation of its content. After checking in with this community, the examination policy group will consider any feedback they received, and – if appropriate – update the draft version of the blueprint, before arriving at a final version that will be used to inform the design of the actual assessment.



Next Stage | Filling your Item Bank

Now that your organization has a valid and well-considered examination blueprint, it is time to start writing questions!

Stage 2 of the Assessment Life Cycle is when the actual test questions are written, leading to the creation and population of something called an item bank. In this stage, questions are written to conform with the examination blueprint that was created in Stage 1 (including the correct number of items, number of exam forms, testing approach, etc.).

Alignment of all questions to the blueprint and competency profile is critical to success at this stage. To help ensure that this is the case, all questions are written by subject matter experts who have a strong grasp of the subject matter, as well as the target population being assessed. A psychometrician or other item bank manager generally organizes and coordinates this process; and keeps track of the questions being written in order to make sure that the questions actually require the skill or knowledge indicated in the blueprint; and that the resulting item bank has the correct proportions (as defined by the examination blueprint).

Conclusion

In summary, the Assessment Life Cycle is a way of organizing the processes involved in creating valid assessments into a series of easy-to-understand, logical stages. The focus of this whitepaper was to detail the fundamental steps and key processes that are involved in the first of these stages (i.e., defining test specifications and creating an examination blueprint). As covered, this involves a number of specific steps, including:

1. Creating a competency profile
2. Surveying practitioners in the field
3. Creating a weighting formula
4. Calculating competency weights
5. Making holistic examination blueprint decisions
6. Generating a draft examination blueprint

Following these best practice steps – and the Assessment Life Cycle in general – will help ensure that your assessment program is valid and defensible; affording the greatest possible benefit to both your test-takers and your organization.

Let Meazure Learning help you apply the Assessment Life Cycle to your assessment program. Meazure Learning offers a full range of products and services that cover every step and process. Our clients agree: we know testing; and we will work hard to make sure that your testing program is the best that it can be.

To explore this opportunity – or for more information – please feel free to visit us at:
meazurelearning.com/services

List of Psychometric Services offered in Assessment Life Cycle Stage 1

At Meazure Learning, we provide a host of services to our clients that encompass each of the Assessment Life Cycle stages. Below is a list of psychometric services that Meazure Learning offers specifically for **Stage 1: Defining Targets and Creating Test Specifications:**

Service	Description
<i>Competency Profile Development</i>	<p>Creating a full inventory of the skills and knowledge encompassed in a job role can be a time-consuming and detailed-oriented process; but one that is vital to the success of any assessment program. The resulting competency profile for a profession defines what professionals in a given job role should know and be able to do within their role. Often, a competency profile will not only specify which skills, knowledge, behaviors, or attitudes are required for mastery of the subject area; but also the criticality of each of these.</p> <p>At Meazure Learning, we'll work with clients through the entire process of generating and validating a competency profile. We have experience doing this across a number of domain areas, including a range of health professions (e.g., opticians, nursing, physiotherapy, dental hygiene), science and engineering (including work with the petroleum industry), and law enforcement.</p>
<i>Examination Blueprint Development</i>	<p>Once a competency profile has been developed, an examination blueprint must be created. This blueprint outlines the specifications for an examination, and is based on criticality weighting for each competency.</p> <p>At Meazure Learning, we help guide clients through the steps required to develop a blueprint, including:</p> <ol style="list-style-type: none"> 1. Creating a competency profile 2. Surveying practitioners in the field 3. Creating a weighting formula 4. Calculating competency weights 5. Making holistic examination blueprint decisions 6. Generating a draft examination blueprint