Competency Modeling, Job Analysis, and Test Design for Credentialing Tests

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Over the past 25 years, competency modeling has gained prominence as a way for businesses to guide strategic planning and HR functions such as personnel selection, staff training, performance evaluation, and compensation benchmarking. The influence of competency modeling has recently stretched into the not-for-profit sector, with competency frameworks being promoted in fields such as accounting, engineering, nursing, and psychology. For example, a few of the prominent educational organizations in veterinary medicine recently adopted a competency framework that includes competency domains such as multi-species knowledge – which you'd expect – along with domains that you might not expect but can none-the-less appreciate – domains such as communication, leadership, multicultural awareness, and adaptability. For those of us in the testing business, developing assessments to get at such skills is no simple order.

So, over the next 15 minutes I'll talk about competency models, compare and contrast them with traditional job analysis, and discuss strategies for developing test blueprints from competency models.

While the term *competency* lacks a useful agreed upon definition, both proponents and critics acknowledge that a competency is a broad statement indicating *the behavioral themes that an organization views as core to successful performance*. Here are a couple of the definitions from one literature review: ***see slide***

Although the first definition is less flattering than the first, one might conclude that they are functionally equivalent. Both of them define competency as a complex construct consisting of *a lot of stuff*, running the gamut from job activities to KSAs to values, and other personal qualities.

Let's get more concrete. Another example of competency modeling is the CanMEDS framework adopted by the Royal College of Physicians and Surgeons of Canada. The CanMEDS framework specifies 7 roles of the competent physician: medical expert, collaborator, health advocate, and 3 others. Each role is defined and specific competencies are listed under each. Here is an excerpt from the *Health Advocate* role:

> ***As health advocates, physicians responsibly use their expertise and influence to advance the health and well-being of individual patients, communities, and populations.***

Each competency is supported by several specific competencies and enabling competencies. Here is one sample competency for Health Advocate:

> ***Physicians respond to the health needs of the communities that they serve***.

And below that are a few enabling competencies. The good news is that these enabling competencies do provide some specificity. However, they still are vague and present some obvious measurement challenges. Anyway, this very limited sample conveys a key feature of competencies – they *prescribe* job activities.

Some History

So where did this focus on competency come from? Let me give a brief history. In 1973, the Harvard psychologist David McClelland published an article criticizing cognitive ability testing. He was more or less casting dispersion on the predictor-centric approach to testing where tests of abstract skills, such as verbal analogies, are used to predict some criterion of interest, like grades in college. His argument was that the best tests did not assess abstract skills, but sampled behaviors from the criterion of interest. Tests should assess competencies involved in clusters of real-life outcomes. I mean, how many jobs require you to do word analogies… … that was the reasoning.

Let's note in passing that during the late 1980s, Robert Sternberg was advocating assessment of practical intelligence, or tacit knowledge, and that Gardner's work on multiple intelligences seemed to influence the competency movement. And I suspect the criterion-referenced testing movement of the 1960s and 70s had an influence.

Another thread in the tapestry of competency modeling can be traced to a 1990 article in the Harvard Business Review called the "Core Competence of the Organization." While this article focused mostly on organizational competencies rather than individual competencies, it also noted the importance of a work force that embodies those competencies. So then, it trickled over into job analysis, and began to replace job analysis as the strategy for listing job requirements.

Here is a sample of the types of competencies that populate the business world. ***slide with business competencies.*** The issue is not so much that these are difficult to assess. And the issue is not so much that they are amalgamations, although that is certainly true. The challenge is that these competencies are important for most professions. If you were to administer a job analysis survey consisting of these competencies to a sample of nurses, a sample of physicians, a sample of engineers, a sample of physicians, a sample of psychologists, and a sample of teachers, you would probably find that each competency would be deemed very important to all professions. That is, it would be hard to differentiate these various professions based on the results. Let's take this thought experiment a step farther and now build test blueprints from those job analysis survey results … if we used just the results based on those competencies, the test blueprints for these different professions would look very similar, which obviously would be a problem.

Well, back to the history of competencies: The traditional I/O psychologists analysts started getting nervous – not just about their eroding business, but about the erosion of what they saw as the basis

of scientific management – that basis being an accurate description of the job. So, in the late 1990s the Society for Industrial and Organizational Psychology convened a task force Job Analysis and Competency modeling. It was called by some as a "wake-up call."

The task force reviewed the literature, interviewed SMEs, and surveyed HR specialists. They did a survey of SMEs and asked them to compare job analysis and competency modeling on a variety of factors. The only criteria that competency modeling was viewed as superior was "*Links job behaviors to business goals and strategies.*" In most other ways, traditional job analysis was seen as superior.

None-the-less, the traditional job analysts finally waved the white flag in a 2009 article by Sanchez and Levine. They acknowledged competency modeling as a necessary and overdue adjunct to job analysis. However, they also point out that competency models can benefit from the additional specificity provided by traditional job analysis. The Sanchez & Levine article highlighted several differences between competency modeling and traditional approaches to job and practice analysis, as ***summarized on this slide***:

- Practice analysis seeks to objectively document work-related behaviors, while competency modeling seeks to influence behaviors.
- One is *descriptive*; the other is *prescriptive*; One focuses on the *present*, while the other is oriented toward *future* goals.
- Practice analysis is *bottom up*, with workers *revealing* their daily activities, while competency modeling is more *top down*, with the organization stating the behavioral themes that it values.
- Practice analysis describes the *typical* performance of an average or even minimally competent person, while competency modeling strives to inspire *maximum* performance.
- The results of practice analysis is a list of discreet tasks and KSAs that highlights what makes a job or profession or unique. Meanwhile, competency models list behavioral themes common across jobs.

Competency frameworks can play a useful role in the evolution of professions. They can help professions stay current, relevant, and competitive. One consequence I have observed is that since competencies often focus on soft skills, or noncognitive skills, they force credentialing agencies to explicitly consider whether they believe their tests should attempt to measure such skills. Given that MCQs don't get at many of these competencies, the credentialing agency must reckon with whether into performance testing is worthwhile or not, and that reckoning process can be a good thing.

However, competency models have several limitations and need to be applied with rigor and creativity when developing test blueprints for professional certification. First, there is the Facebook effect: they are prone to positive response bias and inflated perceptions of value. A second limitation is that competency statements lack the specificity for item writing and, quite frankly, often do not connote measureable skills. A third problem is that a competency is typically some complex combination of

multiple constructs. For example, the competency called *interpersonal and communication skills* likely includes a smattering of personality constructs such as agreeableness and conscientiousness, as well as language fluency. Finally, while forward-thinking competencies that emphasize superior performance may help organizations advance their missions, the relevance of such competencies to the purpose of licensure – which is to protect the public by ensuring *minimal* competence of entry-level practitioners – should not be taken for granted.

In spite of these limitations, competency modeling it is a practice analysis strategy that test developers in credentialing can't afford to ignore. But it should not be the sole source of information when designing credentialing tests. I'd like to discuss a few strategies that I have used to squeeze meaning out of competency modeling. They are:

1. Start with the competency framework, but fill it out with traditional job activities where possible.
2. Try to restate the competencies in terms of known psychological constructs. For example, Pat Kyllonen has a chapter in the *Handbook of Test Development* about the assessment of noncognitive skills, and in that chapter he provides a crosswalk between so-called 21st century skills and well-supported psychological constructs such as the Big 5.
3. Include competencies in the linkage activity.
4. Conduct analyses to test and refine the competency framework.
5. Use a test blueprint that has two dimensions: one corresponding to competencies and one corresponding to traditional knowledge and skill domains. In other words, a content-by-process matrix provides a way to work competencies into the test blueprint without confined to it.

I'll walk through an example to clarify some of these strategies. In medicine there is a framework known as the ACGME competencies. It comprises 6 major domains including Patient Care, Interpersonal Skills, Professionalism, and a few others.

The first step in practice analysis is to break those competencies into subcompetencies, and then into specific job activities. I found it helpful to organize the competencies in this instance into technical and nontechnical activities. Next, add some detail: A broad competency like "Patient Care" needs to broken down into specific activities as shown on the figure. Basically, the idea is to get traditional job analysis ratings on these activities – like ratings of task frequency or task importance.

Once that is done, it is useful to conduct what is called a linkage exercise. The goal of a linkage exercise is to identify the knowledge, skills, and other attributes required to perform the activities identified through a job analysis. Its purpose is to connect often unobservable constructs to observable job activities. One way or another, implicitly or explicitly, this has to be done in order to specify measurable skills. These connections can be established in a variety of ways, most requiring the judgments of SMEs. Methods of cognitive task analysis – such as think-aloud protocol – also work well,

although it can be labor intensive. A more practical approach is to have SMEs rate the extent to which each job activity required each knowledge domain or personal attribute.

The outcomes of the linkage activity really create the foundation, or lowest level of, the competency framework, ***as shown in this slide***. The ***next slide*** shows a more specific instance where the foundational level includes actual knowledge domains and personal qualities. Now, I think I could design a test to measure what is specified at the lowest level here. To be completely honest, the results may not appear so tidy because there will be a lot of crossed lines, but you get the idea.

Let me talk for a few minutes about verifying the competency domain (***new slide***). Five or six years ago, a study was published on the structure of the content domains for a statewide math test. The official competency framework for test development and subscore reporting consisted of categories such as algebra, data analysis, geometry, measurement, number reasoning. The study in question wondered whether that framework really captured the way that math skills covary." So, the authors, Jerome D'Agostino and colleagues, asked math teachers to sort math items into piles based on their similarity. The data were subjected to multivariate analysis, which suggested a very different competency framework – one that produced more meaningful subscores than the original one, as subsequently verified through confirmatory factor analysis of actual item responses.

It is important not to accept any old framework. I feel quite certain that most competency models, whether it is ACGME, or the Canadian physician model, or the 8 great competencies discussed in business literature generally do not provide useful ways to organize test content for purposes of producing useful subscores.

I have been applying this type of technique in job analysis for about 25 years now, and have found it to be very useful. In one recent example, I obtained similarity ratings among 16 competency domains in medicine and used multidimensional scaling and cluster analysis to make sense of the results. More recently, about 6 months ago, we had a sample of about 25 veterinarians sort 105 job activities into piles based on similarity. The results were then compared to the competency framework that was originally used to generate the task statements. There are several programs now available to perform card-few sorting studies online. It is fairly easy to use and SMEs seem to like the process.

Let's return to an earlier slide just to make sure we have touched on all of the strategies. Let me say a few words about the 5th one on the list – the rationale for the content by process matrix. In educational testing the process dimension usually refers to the skill domain or cognitive complexity… something like Bloom's taxonomy. For credentialing tests the process dimension can consist of competencies – which are more about the things that people do rather than the cognitive process required to solve a test item. A test blueprint matrix provides a good way to work a competency framework into the test without sacrificing traditional content and constructs.

To close out, I'd like to point out that these 5 strategies are not a package deal. So for example, the project that I am just now finishing up with the veterinarians did not go through the linkage exercise with SMEs; it will be done later as we classify test items into both process dimensions and two content dimensions. Nor is step 4 necessary. But I have found that these ideas can provide substance and structure to an potentially ambiguous competency framework.

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