

BLOOM'S TAXONOMY

>> AN ALTERNATIVE APPROACH TO DEVELOPING MULTIPLE-CHOICE T & E QUESTIONS

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Training and experience (T&E) questionnaires are one of the most common assessment tools utilized during the Federal hiring process (Partnership for Public Service, 2004). In addition to being cost effective and consistent with merit-based hiring, T&E items typically require a low level of training and oversight to implement (McGonigle & Curnow, 2006).

Multiple-choice (MC) questions are often used to obtain information on job relevant competencies or knowledge, skills and abilities (KSAs). In many instances, highly customized questions are developed for each vacancy. When properly constructed and based on a valid job analysis, customized questions result in differentiation among applicants in a valid and legally defensible manner. However, high quality, experience-based questions are difficult to write, especially those designed to assess competence or proficiency on scale ranging from low to high using examples of actual work behaviors representing different levels of performance.

In an apparent attempt to speed the question development process, while at the same time preserving the customized position specific aspect of MC questions, many agencies have chosen what are commonly called Applicant Assessment (AA) type questions. AA questions usually include a job task or competency in the stem of the question, and a standardized scale of answer choices that usually assesses one dimension of experience—i.e., level of responsibility, independence and/or autonomy in performing the task or applying the competency. For example, consider the following AA question.

Which of the following best describes your level of education or experience in preserving and reloading customer data in order to restore customer functionality between?

- I have not had education, training or experience in performing this task.
- I have had education or training in performing this task, but have not yet performed it on the job.
- I have performed this task on the job, with close supervision from supervisor or senior employee.
- I have routinely and independently performed this task as a regular part of the job, and usually without review by supervisor or senior employee.
- I am highly skilled at performing this task on the job. I have trained others in this activity and/or others have consulted me as an expert for assistance.

While AA questions of this type are easy to write, the exclusive use of these types of questions in a job vacancy announcement presents at least two problems. First, they limit the amount information collected (and therefore what is learned about the applicant) to only one dimension of competence or proficiency—i.e., level of supervision under which the applicant performed a task or applied a competency/KSA. Except for the reference to having trained others found in the last answer choice, this question is mostly about determining whether the applicant has performed the task independently versus under close supervision. Level of independence is only one of many possible relevant dimensions of interest one could consider in assessing applicants on “preserving and reloading customer data in order to restore customer functionality.” The second problem

is that, over time, anecdotal evidence across several agencies indicates that applicants tend to inflate their self-rating in order to increase their chances of getting an interview, particularly if the entire set of questions in the job vacancy includes only this one type of question.

Thus, the challenge in developing good MC applicant screening questions is to devise a method or scheme that will inform and guide subject matter experts (SMEs) and HR Specialists in developing job relevant behavioral examples that form an appropriate scale. In particular, guidance is needed to assist and support SMEs or HR Specialists in recognizing or creating sample work behaviors that reflect true differences in level of competence or proficiency along a scale of task difficulty or complexity. This paper discusses an approach borrowed from the field of education and educational assessment

Bloom's Taxonomy of Learning - Cognitive, Affective, Psychomotor Domains

Bloom's Taxonomy was initially published in 1956 by academic and educational expert Dr Benjamin S Bloom. 'Bloom's Taxonomy' was originally created in and for an academic context in order to develop a system of categories of learning behavior to assist in the design and assessment of educational learning (<http://www.businessballs.com/bloomstaxonomyoflearningdomains.htm>). Bloom's Taxonomy has since been expanded over many years by Bloom and other contributors as recently as 2001, whose theories extend Bloom's work.

Although Bloom's Taxonomy was primarily created for academic education, it is recognized as being relevant to all types of learning (need a reference here, such as Cronbach or other educational research/testing guru). Thus, just as this taxonomy is useful for writing educational objectives, designing instructions, and assessing learning, it also appears relevant for designing work and assessing work performance, competence or proficiency.

Bloom's Taxonomy model consists of three parts or 'overlapping domains' as shown below:

1. Cognitive domain (intellectual capability, i.e., knowledge, or 'think')
2. Affective domain (feelings, emotions and behavior, i.e., attitude, or 'feel')
3. Psychomotor domain (manual and physical skills, i.e., skills, or 'do')

Cognitive Knowledge	Affective Attitude	Psychomotor Skills
1. Recall data	1. Receive (awareness)	1. Imitation (copy)
2. Understand	2. Respond (react)	2. Manipulation (follow instructions)
3. Apply (use)	3. Value (understand and act)	3. Develop Precision
4. Analyze (structure/elements)	4. Organize personal value system	4. Articulation (combine, integrate related skills)
5. Synthesize (create/build)	5. Internalize value system (adopt behavior)	5. Naturalization (automate, become expert)
6. Evaluate (assess, judge in relational terms)		

In each of the three domains the taxonomy is based on the premise that the categories are ordered in degree of difficulty. **An important premise of Bloom's Taxonomy is that each category (or 'level') must be mastered before progressing to the next.** (Note the educational or academic learning theme here.) As such, the categories within each domain are levels of learning development, and these levels increase in difficulty. Likewise, it is argued here, that it is not uncommon in the world of work that work performers develop work related competence by learning and mastering job tasks of increasing difficulty over time, and that they do that by mastering one level of task, requiring one level of competence, before moving on to the next. Thus, assessing an applicant at any point in time on a given work related competency or KSA is very much like assessing his/her level of mastery in an educational setting. That is, by measuring and observing how the applicants perform on test items designed to be of greater or less difficulty modeled after and guided by Bloom's taxonomy

In the Cognitive Domain, levels 5 and 6, Synthesis and Evaluation, were subsequently inverted by Anderson and Krathwhol in 2001 (<http://www.businessballs.com/bloomstaxonomyoflearningdomains.htm>).

Since applicants to many federal jobs will be assessed on competencies and KSAs that fall into the cognitive domain, the cognitive domain is presented in greater detail in the table below.

Category or 'level'	Examples of activity to be trained, or demonstration and evidence to be measured	'Key words' (verbs which describe the activity to be trained or measured at each level)
Knowledge - recall or recognize information	multiple-choice test, recount facts or statistics, recall a process, rules, definitions; quote law or procedure	arrange, define, describe, label, list, memorize, recognize, relate, reproduce, select, state
Comprehension - Understand meaning, re-state data in one's own words, interpret, extrapolate, translate	explain or interpret meaning from a given scenario or statement, suggest treatment, reaction or solution to given problem, create examples or metaphors	explain, reiterate, reword, critique, classify, summarize, illustrate, translate, review, report, discuss, re-write, estimate, interpret, theorize, paraphrase, reference, example
Application - use or apply knowledge, put theory into practice, use knowledge in response to real circumstances	put a theory into practical effect, demonstrate, solve a problem, manage an activity	use, apply, discover, manage, execute, solve, produce, implement, construct, change, prepare, conduct, perform, react, respond, role-play
Analysis - Interpret elements, organizational principles, structure, construction, internal relationships; quality, reliability of individual components	identify constituent parts and functions of a process or concept, or de-construct a methodology or process, making qualitative assessment of elements, relationships, values and effects; measure requirements or needs	analyze, break down, catalogue, compare, quantify, measure, test, examine, experiment, relate, graph, diagram, plot, extrapolate, value, divide
Synthesis (create/build) - develop new unique structures, systems, models, approaches, ideas; creative thinking, operations	develop plans or procedures, design solutions, integrate methods, resources, ideas, parts; create teams or new approaches, write protocols or contingencies	develop, plan, build, create, design, organize, revise, formulate, propose, establish, assemble, integrate, re-arrange, modify
Evaluation -	review strategic options or plans	review, justify, assess, present a

Category or 'level'	Examples of activity to be trained, or demonstration and evidence to be measured	'Key words' (verbs which describe the activity to be trained or measured at each level)
Assess effectiveness of whole concepts, in relation to values, outputs, efficacy, viability; critical thinking, strategic comparison and review; judgment relating to external criteria	in terms of efficacy, return on investment or cost-effectiveness, practicability; assess sustainability; perform a SWOT analysis in relation to alternatives; produce a financial justification for a proposition or venture, calculate the effects of a plan or strategy; perform a detailed and costed risk analysis with recommendations and justifications	case for, defend, report on, investigate, direct, appraise, argue, project-manage

As mentioned previously, the question of the order of Synthesis and Evaluation is dependent upon the extent of strategic expectation and authority that is built into each, which depends on your situation. Hence it is possible to make a case for Bloom's original order shown above, or Anderson and Krathwhol's version of 2001 (which simply inverts levels 5 and 6), with the ultimate decision hinging on whether the category chosen as level 6 includes strategic thinking or strategic authority—the requirement for level 6, i.e., the highest level.

Additional Illustration of Bloom's Cognitive Domain

Over the years, educators and other users of the taxonomy have expanded the reference list of action verbs and examples that apply to each of the levels. The table below is an example of such an expansion that also includes other examples of work or work products.

Category	Examples	Key Words
Knowledge: Recall data or information.	Examples: Recite a policy. Quote prices from memory to a customer. Knows the safety rules.	defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.
Comprehension: Understand the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.	Examples: Rewrites the principles of test writing. Explain in one's own words the steps for performing a complex task. Translates an equation into a computer spreadsheet	comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives Examples, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates.
Application: Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.	Examples: Use a manual to calculate an employee's vacation time. Apply laws of statistics to evaluate the reliability of a written test.	applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.

<p>Analysis: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.</p>	<p>Examples: Troubleshoot a piece of equipment by using logical deduction. Recognize logical fallacies in reasoning. Gathers information from a department and selects the required tasks for training.</p>	<p>analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates.</p>
<p>Synthesis: Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.</p>	<p>Examples: Write a company operations or process manual. Design a machine to perform a specific task. Integrates training from several sources to solve a problem. Revises and process to improve the outcome.</p>	<p>categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes.</p>
<p>Evaluation: Make judgments about the value of ideas or materials.</p>	<p>Examples: Select the most effective solution. Hire the most qualified candidate. Explain and justify a new budget.</p>	<p>appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports.</p>

See <http://www.nwlink.com/~Donclark/hrd/bloom.html>

Using Bloom's Taxonomy in Developing Multiple-Choice T & E Questions

The argument for using Bloom's Taxonomy to guide the development of MC training and experience questions is this:

If MC assessment items are desired as a way to reflect a graduated scale of increasingly more difficult job tasks and/or learning, and, if the cognitive domain of Bloom's Taxonomy is designed to reflect increasing complexity/difficulty of behaviors serving as evidence of learning, then using the various levels of Bloom's Taxonomy (and the associated verbs) to guide and inform the answer choices used to indicate level of competence or proficiency in job related competencies appears straightforward and applicable.

To illustrate with a concrete example, let's suppose an MC question is needed to assess competency or proficiency in the following MOSAIC Professional and Administrative/Technical competency a GS 12 position:

Personnel and Human Resources - Knowledge of hiring, classification, benefits, labor relations, negotiation, and federal, state, and local employment regulations.

Modeled after Bloom's Cognitive Domain, the following template was created to guide question development for the root question (i.e., the question "stem") and the answer choices:

Select the answer choice that best describes your level of experience and/or expertise in [cite the knowledge or experience area of interest related to the stated competency].

(A) **(Knowledge Level)** - observed, listed, defined, told, described, identified, showed, labeled, collected, examined, tabulated, quoted, named, etc.

- (B) **(Comprehension Level)** - summarized, described, interpreted, contrasted, predicted, associated, distinguished, estimated, differentiated, discussed, extended, etc.
- (C) **(Application Level)** - applied, demonstrated, calculated, completed, illustrated, showed, solved, examined, modified, related, changed, classified, experimented, discovered, etc.
- (D) **(Analysis Level)** - analyzed, separated, ordered, explained, connected, classified, arranged, divided, compared, selected, explained, inferred, etc.
- (E) **(Synthesis Level)** - combined, integrated, modified, rearranged, substituted, planned, created, designed, invented, asked `what if?`, composed, formulated, prepared, generalized, rewrote, etc.
- (F) **(Evaluation Level)** - assessed, decided, ranked, graded, tested, measured, recommended, convinced, selected, judged, explained, discriminated, supported, concluded, compared, summarized, etc.

Note in this example that the highlighted portions of each answer represent action verbs selected from (or modeled after) the corresponding levels of Bloom's Taxonomy. Also note that if only five answer choices were desired, some of the levels can be combined fairly easily. For example, one could combine the Knowledge and Comprehension levels, as well as the Synthesis and Evaluation levels. The question below combines those levels for the sample question above to create four substantive answer choices followed by 'None of the above'.

Select the answer choice that best describes your level of experience and/or expertise in the recruitment and placement of federal employees.

- (A) I have **provided and interpreted instructions** for junior level staffing specialists on the steps to prepare and post job announcements for professional and administrative, scientific and technical, clerical and administrative support and student positions at all grade levels.
(Knowledge and Comprehension Level)
- (B) Same as "C" above. **(Application Level)**
- (C) Same as "D" above. **(Analysis Level)**
- (D) I have **researched, analyzed and developed** viable procedures, made **recommendations** to improve operations in position and pay management, classification and/or staffing; **monitored and evaluated** the effectiveness of new programs, **measured** results, and **recommended** changes based upon reasoned **conclusions.** **(Synthesis and Evaluation Level)**
- (E) None of the above.

Summary and Conclusions

Blooms' Taxonomy (Cognitive Domain) was explained and illustrated. An argument was presented for building MC Training & Education questions that form a graduated scale. The answer choices form what are essentially behavioral benchmarks that can be used to assess level of proficiency in a given competency.

The challenge in writing such questions is to know enough about the typical work activities that draw upon the competency of interest. In the example used, expertise in Personnel and Human Resources, with an emphasis in hiring (i.e., recruitment and placement) was required. With this expertise, and with the guidance provided by the template, it is suggested here that a well qualified SME would be able to develop appropriate answer choices by matching real world work activities to the levels of the taxonomy. This should result in questions that have clear and relevant face validity (i.e., due to the job context nature of the work behaviors used as benchmarks), as well as questions that differentiate job applicants in a valid and legally defensible manner.