# Selecting Appropriate Assessment Methods: Asking the Right Questions

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Professional organizations are emphasizing performance assessment as a preferred testing strategy; however, this may not always be the best approach in every situation. Assessment methods should be viewed along a continuum of less to more performance-oriented, lower to higher order thinking, and less to more authentic. Recognizing the components of the assessment process (nature of the task, level of cognitive processing, and context) is key in selecting the most appropriate assessment tools for demonstrating desired learning outcomes. The purpose of this article is to provide a framework for analyzing the types and levels of learning, demonstrate how to develop an assessment strategy appropriate for the learning objectives and describe the appropriate use of performance assessment in pharmacy education. A practical example of how these principles were applied in two senior courses is presented.

## INTRODUCTION

Increasingly, professional organizations and accrediting bodies are recommending performance-based assessment of students enrolled in professional degree programs and many schools and colleges are rising to meet this challenge(1). The American Association of Colleges of Pharmacy (AACP) adopted a working definition of performance assessment based on statements by the American Association of Higher Education (AAHE) and other sources. The definition makes the expectations for performance-based assessment more concrete and is as follows:

Assessment of ability that requires demonstration of the ability rather than response to proxy measures of the ability(2). An example [is] of students writing rather than responding to multiple choice questions about writing. Performance assessment is a type of assessment that requires students to actually perform, demonstrate, construct, and/or develop a product or a solution under defined conditions and standard(3). Performance assessments imply active student production of evidence of learning - not multiple-choice, which is essentially passive selection among preconstructed answers [2].

Given the above definition, instructors may conclude that (*i*) multiple-choice tests are not a good way to assess students, and (*ii*) all learning outcomes are best assessed with performance-based tests. Both of these conclusions would be erroneous. When deciding how to assess learning, two factors should guide an instructor's decision. The first and most important is "which assessment method best measures what students should be able to do as a result of instruction?" For example, if students are to identify characteristics of disease states, then a multiple-choice test may be the best way to measure that outcome. The assumption behind the first question is that instruction reflects the desired learning outcome. Thus, the assessment task matches both the instruction and the stated behavior in the learning objective(4). The second question is, "Given the available resources, which method of assessment is most feasible?" Class size, amount of instructional time devoted to assessment, and instructor time allotted to teaching duties are all factors that should be considered when designing assessments. Assessment activities that place an unreasonable burden on the instructor(s), without consideration of other duties, would be classified as unfeasible.

In reality, assessment is on continuums of less to more performance-oriented, lower to higher order thinking, and less to more authentic (assessment in real life context)(5). Recognizing the underlying characteristics of assessment (nature of the task, level of cognitive processing, and context) is the first step in determining the appropriate assessment options. The purpose of this article is to provide a framework for analyzing the types and levels of learning, demonstrate how to develop an assessment strategy appropriate for the learning objectives and describe the appropriate use of performance assessment in pharmacy education.

## TYPES OF KNOWLEDGE

Performance assessment may not be the best assessment technique for all types of learning, because the selection of an assessment technique depends on the nature of the learning or knowledge being assessed. Cognitive psychologists recognize three distinct types of knowledge - declarative, procedural, and conditional(6-9). Declarative knowledge is "knowing that"

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[2]American Association of Colleges of Pharmacy Chair Report of the 1998-1999 Academic Affairs Committee. Presented at the 1999 AACP meeting in San Diego, CA.

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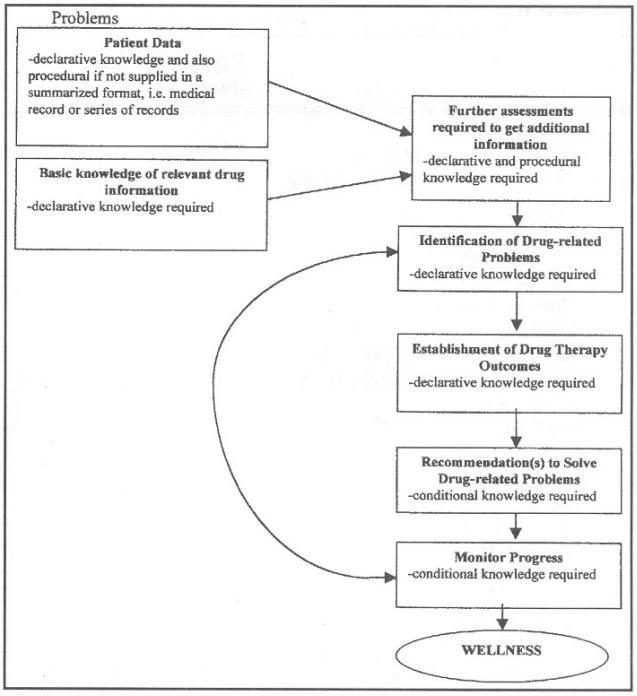


*Fig. 1. Framework to determine type of knowledge used in pharmaceutical care.*

something is so. Facts and other verbal information "declared" through discourse or text are included in this category. For example, the periodic table of chemicals is an example of verbal information. Verbal information is typically assessed using traditional approaches such as multiple choice, fill in the blank or matching questions.

Procedural knowledge is "knowing how" to execute a skill or apply concepts and principles to specific situations. Filling a prescription, compounding a standard formulation, completing a bioassay, processing a nonformulary request, completing an insurance form, and entering a medication order into a computer all require procedural knowledge. A student could explain how to do these activities, but the knowledge would then be declarative in nature. In order to qualify as procedural, the learning must be demonstrated. Therefore, this type of knowledge is best assessed through performance.

Closely related to the other two is conditional knowledge, "knowing when and why" to utilize declarative or procedural knowledge. Some learning theorists refer to this type of knowledge as cognitive strategies(10). An example of conditional knowledge is that pharmacy interns should be able to strategically use their knowledge of drug interactions when consulting a patient's medical records prior to filling a new prescription. They would need to be able to decide if an interaction exists (declarative) and if so does it apply to this patient (procedural) and then what action to take in either counseling the patient or calling the prescriber (conditional). Like procedural, conditional knowledge is usually best demonstrated through performance.

The important point to remember is that the purpose of the learning objective should be reflected in the assessment. A proponent of performance assessment, Gardner states that "most individuals involved in education do not have a clear sense of the nature of understanding, nor do they know how to document that it has (or has not) been achieved"(11). He advocates teachers "be 'freed' ...to assess students in terms of relevant performance"(12). For example, students of mathematics should be able to fill out their tax returns, explain their investment strategies and gains/losses, measure quantities when the need arises in everyday life, and understand the principles of mortgage payments and insurance premiums. He posits that "understandings can only be apprehended and appreciated if they are performed by a student"(13).

## DEVELOPING AN ASSESSMENT STRATEGY

When developing an assessment strategy, one must consider how each characteristic of the assessment relates to the course instruction and learning outcomes. Three questions should be addressed:

### 1. What is the nature of the task?

The type of cognitive processing that is required to "learn" the material is the underlying factor in determining the nature of the task. In addition, the nature of the task should be closely related to the stated learning outcomes for the instruction. Consider a learning objective that is not performance-based first. For example, if the learning outcome is to identify whether any of the eight drug-related problems exist in a specific patient case, then a case study with multiple-choice questions might be appropriate. In this example, the task is to "identify" whether and which drug-related problems exist. In contrast, higher-level assessment items might ask students to actually solve the problems by recommending a specific intervention. These activities might be performance-based in nature. Essentially, one needs to map the types of knowledge the student is expected to use (declarative, procedural, conditional) in accomplishing the course objectives. The choice of assessment method should be guided by this map (Figure 1).

### 2. At what level of cognitive processing should students demonstrate learning?

This question is closely related to the prior question. Whereas, the first question addresses the nature of the task (what should students be able to do?), the second question involves the level at which students should be able to think about the material. Bloom's Taxonomy of Objectives delineates the cognitive domains of learning and is a good reference for identifying the cognitive level of learning outcomes. The taxonomy includes six hierarchical levels: knowledge, comprehension, application, analysis, synthesis, and evaluation(5). An important principle of cognitive psychology is conveyed by this taxonomy; learning is hierarchical. In other words, new learning builds on prior learning. The foundation of learning is basic knowledge of the subject matter and it is worthy of being taught and tested(14). In our example above, "identification" is typically a knowledge level task; however, the cognitive level depends on how the material was taught as well as how it is assessed. In our example, "identification" is most likely a comprehension or application level item because the assessment task (identifying in a patient case) requires students to "apply principles or concepts in a new situation"(15).

### 3. What is the appropriate context for the assessment?

Context is the "setting" of the assessment. It has to do with determining the format of the test. Format can generally be divided into two types: selected and constructed response. Selected response items are typically multiple or binary-choice, whereas constructed test items range from short answer

**Table I. Table of specifications for Evidence-Based Medicine I and II**

| | Learning objectives | K-C | A-A | E-S | Percent or number of items |
|---|---|---|---|---|---|
| 1. | Define, develop, and implement the evidence-based medicine skills needed for pharmacists | Bullets I-25pt<br>Bullets II-25pt | IRA-50pt<br>J.C.-50pt<br>Final I-5pt<br>P&T-5pt<br>Crit Path-5pt<br>Thr Case-5pt<br>Quizzes II-50pt<br>Final II-15pt | M.S.-5pt<br>Quizzes I-30pt | 270pts or 22% |
| 2. | Define and apply the concepts of evidence-based medicine in making health-care decisions | Bullets I-25pt<br>Bullets II-25pt | M.S.-5pt<br>Final I-5pt<br>P&T-5pt<br>Crit Path-5pt<br>Thr Case-5pt<br>Quizzes II-50 pt<br>Final II-15pt | 170pts or 14%<br>QuizzesI-30pt | |
| 3. | Define and apply the five levels of evidence | M.S.-10pt<br>Quizzes I-30pt<br>Final I-15pt | 55pts or 5% | | |
| 4. | Evaluate primary literature with regard to the soundness of the research methodology and the appropriateness of the statistical tests(s). | J.C.-25pt<br>M.S.-10pt<br>Quizzes I-30pt<br>Final I-15pt | 80 pts or 7% | | |
| 5. | Apply the ten evaluation points when evaluating an article. | J.C.-25pt<br>M.S.-10pt<br>Quizzes I-30 pt<br>Final I-15pt | 80 pts or 7% | | |
| 6. | Evaluate and analyze multiple articles on the same topic to synthesize a rational, sound, and defensible decision/recommendation. | | M.S.-60pt<br>Final I-95pt<br>P&T-35pt<br>Crit. Path-35pt<br>Thr Case-35pt | 260pts or 21% | |
| 7. | Apply evaluation and analytical principles of evidence-based medicine to specific pharmacy-practice functions. | Bullets -25pt | P&T-55pt<br>Crit. Path-55pt<br>Thr Case-55pt<br>Final II-95pt | 285 pts or 24% | |

Key: K-C indicates the Knowledge and Comprehension levels, A-A indicates the Application and Analysis levels, and S-E indicates the Synthesis and Evaluation levels. We have collapsed the taxonomy into three columns to reduce the amount of analysis required to categorize assessment tools. The "weighting" column is included to allow for consideration of the emphasis placed on the objective in instruction and/or assessment. The amount of weight allotted to an objective during assessment should match the time allotted to or emphasis on the objective during instruction.

Bullets = Post Class Assessment of Key points (*e.g.*, quiz, list of key concepts)
P&T = P&T Monograph Assignment
IRA = Individual Reference Assignment
Crit. Path = Critical Pathway Assignment
JC = Journal Club
Thr Case = Therapeutic Case Study Assignment

items to portfolio assessment. If the format is constructed response, the context is further defined by determining the level of desired authenticity. Another issue is the feasibility of the planned assessment. Can the task be completed within the time limits of the test period, the semester? How many students will complete the task? Is the task an individual or group project? Is an appropriate amount of time available for instructors to score the assessment?

## APPROPRIATE USE OF PERFORMANCE ASSESSMENT

Performance-based assessment is becomingly increasingly common in professional preparation programs. The definition adopted by ACPE calls for "assessment that requires students to actually perform, demonstrate, construct, develop a product or a solution." In performance assessment, requiring "students to actually perform, demonstrate, construct, etc." must be closely connected to the further condition of "demonstration of the ability rather than response to proxy measures of the ability." When both of these conditions are met, the method of assessment is performance-based.

A potential limitation to the use of performance assessment is that instructors often believe that performance assessments are always carried out in real-life contexts(16-17). Thus, course instructors may have a constricted view of what performance assessment is and, therefore, be unlikely to use it across the Pharmacy curriculum. Because of this misconception, instructors may experience difficulties developing assessments that resemble "real life" and/or implement time consuming assessments that lead to frustration and disillusionment with a burdensome process. For example, students are often required to write a formulary review in a Drug Information or Evidence-based Medicine course. The task lacks authenticity if the review is not written for presentation to an actual Pharmacy

**Table II. Summary of assessment methods for Evidence-Based Medicine I and II**

| Assessment tool | Points |
|---|---|
| EBM I | |
| Bullets I | 50 |
| Individual Reference Assignment (IRA) | 50 |
| Journal Club (J.C.) ─ group assignment | 100 |
| Multi Study Assignment (M.S.) ─ group assignment | 100 |
| Quizzes I (3 quizzes worth 50 points each) | 150 |
| Final I | 150 |
| TOTAL | 600 |
| EMB II | |
| Bullets II | 75 |
| P&T Monograph Assignment (P&T) ─ group assignment | 100 |
| Critical Pathway Assignment (Crit. Path) ─ group assignment | 100 |
| Therapeutic Case Study Assignment (Thr Case) | 100 |
| Quizzes II (4 quizzes worth 25 point each) | 100 |
| Final II | 125 |
| TOTAL | 600 |

and Therapeutics committee, but it is an appropriate performance-based assessment that measures the intended learning outcomes of the course. Assessment in a therapeutics class using clinical cases is another example of performance-based assessment that is not authentic assessment. Students are evaluated on their ability to assess the patient data provided to them on the examination, create a problem list, set measurable therapeutics goals and design a pharmaceutical care plan. These activities mimic a practicing pharmacist's work and reflect the desired course outcomes, even though the plans developed by the student are never applied to real patients. A final example is having first year students attempt to resolve a community health issue through designing a pharmacy-centered system of care, even though this new program will not be implemented into practice. At the high end of the authenticity continuum, the focus is on the "application of understandings and skills to real problems in 'real world' contextual settings"(18). In the Pharmacy curriculum, internships and externships, supervised clinical experiences, and any activities that require students to practice their knowledge or skills in a setting very similar to what they will encounter as a professional are considered authentic activities.

## PRACTICAL APPLICATION

A group of faculty members at the University of Missouri-Kansas City redesigned seven credit hours of course work, including Statistics, Drug Information, and Research Methods, into six credit hours of Evidence-Based Medicine (EBM). The course goals are listed in Table I. By the end of the six-credit hours of course work, students should be able to apply evaluation and analytical principles of evidence-based medicine to specific pharmacy-practice functions. Faculty were generally pleased with the learning outcomes for the course as demonstrated by students' performance on multiple performance-based assessments as well as clinical rotations. However, attempts to make all assessments performance-based created an excessive burden on the faculty. In order to resolve this problem, the faculty met with an assessment consultant to analyze the effectiveness and feasibility of current assessment strategies. Immediately, it became apparent that redundancy was built into the plan and, after discussion, faculty decided that the redundancy was not essential in producing the desired outcomes.

The next step was to systematically analyze current assessment practices for the course. The faculty created a Table of Specifications (a chart that delineates the connection between objectives, assessment tools, and desired levels of cognitive processing) to identify redundancy and any other disconnects between learning objectives and assessment methods. This analysis revealed that: (*i*) written article critiques were required in three different assessments, including a group article analysis project, a group multi-study project, and an individual article critique written in class as the final examination; (*ii*) teamwork was emphasized as evidenced by 33 percent of the total points being derived from group assignments; and (*iii*) coverage of the objectives by the assessment tools was adequate.

Through this analysis, the faculty determined that the required level of cognitive processing for course assessments and the context for each assignment were appropriate. However, the faculty reported feeling overwhelmed as the end of each semester neared. They determined that although the nature of each task was appropriate when considered independently, the combined assessment tasks were burdensome. Therefore, the faculty decided to implement new assessment approaches to reduce the time committed to grading multiple written assignments. (see Table I) For example, the final examination was reworked to consist of multiple-choice questions written at the application and higher level of cognitive processing. By changing the nature of one major task, the faculty were able to significantly reduce the time commitment, while maintaining the integrity of the assessment process. In addition, a performance-based focus is still evident in the overall assessment process (Table II).

## SUMMARY

Appropriate assessment strategies are best identified through careful consideration of the nature of the task, the cognitive level of the objective, and the most feasible context for the assessment. Performance assessments can be appropriate throughout the curriculum, not just at the end as a component of a clinical or practical experience. A key factor to consider is whether performance assessment is the best measure of the desired outcomes.

Many instructors believe that authenticity is a defining feature of performance assessment. Instead, we should view

authentic assessment as a type of performance assessment that has the additional characteristic of using a "real life" context. Understandably, this confusion causes instructors concern when course material is introductory and the majority of learning objectives involve understanding new terminology, physiology, or chemical compounds. In addition, issues such as individual characteristics of the students, resource limitations (time, class size, etc.), and accessibility of assessment expertise to assist faculty in designing appropriate assessments must be considered. As such, performance assessment is not always the appropriate method to measure desired learning outcomes. Also, one should not quickly adopt these as excuses to use easier/less time consuming strategies when they are not appropriate.

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