Chapter 9
Developing Training Materials and Programs: Creating Educational Objectives and Assessing Their Attainment

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What if you aren't lucky? What if your pharmacists can't access training resources that will meet all of their training needs? What if you are challenged with developing your own training programs? This chapter is your first step in that process. It will teach you to write educational objectives that accurately define the learning you expect of the pharmacists—step one in designing instruction. Step two is developing a process to assess whether learning occurs. You have already learned to do this in Chapter 7. Step three is deciding how you are going to teach what needs to be learned. Chapter 10 addresses that task.

Defining an Educational Objective

Your ability to interpret and create educational objectives is the foundation of everything you do in designing instruction. You will recall that when you receive a request for drug information, the first thing you do is clarify the information need with the requester. "What's the right dose for gentamicin?" can mean any one of a hundred things. The physician might want an answer about the general range. On the other hand, she may be working on the treatment of a particular patient with some confounding medical problems. Ultimately, the question as you understand it is the question you answer. If it is not the same as the requester's question, you will come up with the wrong answer. Likewise, the educational objective you frame at the beginning of the design process will guide what you teach, how you teach it, and when you judge learning has been achieved. If you don't get that expected learning clear in your mind, then the path you take through instruction and evaluation will be meandering (inefficient) and may not get your learners where you want them to go (ineffective).

An educational objective is a description of an observable and measurable performance whose achievement ensures that the pharmacist has mastered a desired learning. Applied to this book's systematic approach to staff development, these objectives would be statements about learnings associated with the skills in the Pharmacy Practice Competency Checklist in Chapter 6. The term *educational objective* refers to a specific description of exactly what the pharmacist will be expected to do as a result of training.

Educational objectives serve the critical role of guiding the staff developer, preceptors, and pharmacist through designing efficient learning experiences that will prepare the pharmacist to perform the new professional responsibilities you have defined in the job description. Thoughtfully derived, clearly stated, well-implemented objectives are the single most

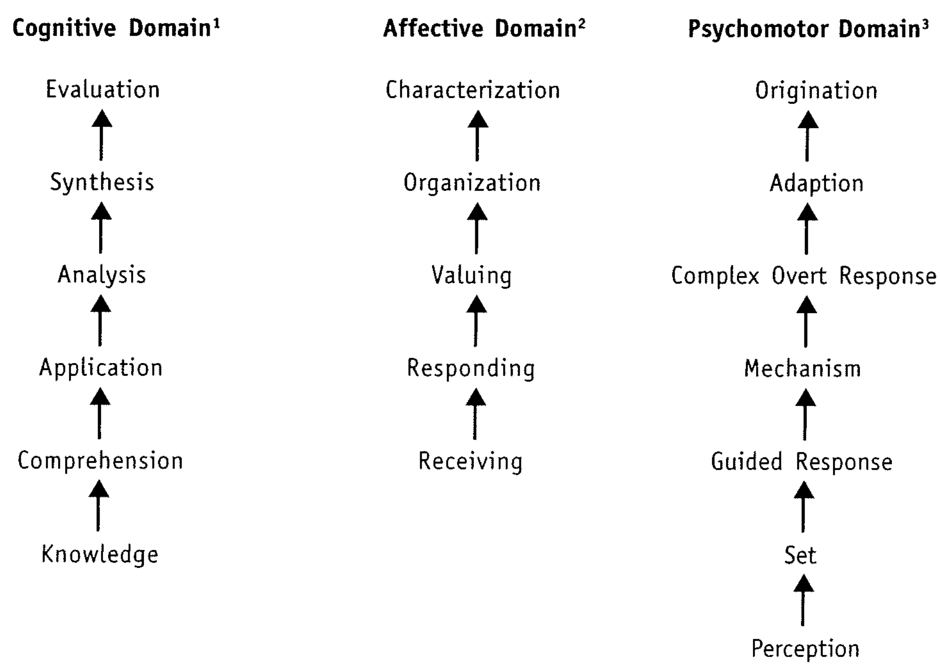

Figure 9-1. Taxonomies of educational objectives

important tool available to all parties involved in staff development. For the staff development coordinator, they provide a clear picture of what the pharmacist in a staff development program must do and how well he or she must do it. For those who act as preceptors for their pharmacy colleagues, objectives provide guidelines on which to base learning experiences for the pharmacist-learner. For pharmacist-learners, objectives provide a focus on what is important to learn.

Objectives are a powerful tool for communication between the staff development coordinator who sets up learning activities, the preceptor, and the pharmacist-learner. Teaching and learning are most efficient when everyone understands exactly what each objective means. Staff training needs to be viewed as a team effort. Speaking the same language and sharing an understanding of the team goal is just good common sense.

Learning Taxonomies

Learning about learning is necessary background for writing good objectives. Knowing how to classify the learning specified for the pharmacist according to taxonomy and level within the taxonomy will provide the information you need to select or design the right kinds of learning experiences to ensure the achievement of each objective. Therefore, as a first step in learning to write objectives, you will learn about the taxonomies and their application to the writing of objectives.

All human learning falls into one of three categories: (1) cognitive, (2) affective, or (3) psychomotor. Figure 9-1 depicts taxonomies used to describe each.[1-3]

Cognitive Domain

Cognitive learning involves remembering or recognizing knowledge or developing intellectual skills or abilities. Most of what pharmacists learn in staff development is cognitive. Bloom's taxonomy of cognitive objectives[1] specifies that cognitive learning occurs in a hierarchical pattern. One must have knowledge before one can understand. One must understand before one can do something with the understanding. One must be able to apply the understanding before one can detect the structure of material. One must be able to detect structure before one can create something new. Finally, one must be capable of creation before one can judge the value of something that has been created.

The following is an interpretation of each of Bloom's levels in pharmacy terms:

Knowledge: Pharmacists remember ideas or material. They can recall or recognize the ideas or material, but they cannot necessarily put a memorized definition into their own words.

Comprehension: Pharmacists grasp the meaning and intent of the material. They can restate what they have learned in their own words and describe the importance of the new material as well as its relationship to related material or ideas.

Application: Pharmacists use a method, theory, principle, or abstraction that they comprehend to solve a problem that is new to them. They use the correct method, theory, principle, or abstraction without being prompted. Pharmacists at this level of learning can perform the activity described in the objective, but they are not yet creative at it. They are good at selecting the right approach and following it through. They would be stumped by something unusual that required creative thinking. In other words, they can "do" the routine.

Analysis: Pharmacists break down material into its constituent parts to determine its parts, the relationships among the parts, or the principles that organize it. Pharmacists use analysis primarily to distinguish relevant from irrelevant material. An example is selecting pertinent data on which to base a decision.

Synthesis: Pharmacists create something new, such as a medication regimen for a patient with numerous medical problems requiring an innovative approach to avert drug interactions and adverse drug reactions. When confronted with a complex problem, they can devise solutions that are not in the standard list of what to do.

Evaluation: Pharmacists can judge the worth of their own and of peers' work according to objective criteria.

Figure 9-2 shows how Bloom's taxonomy for cognitive learning is applied to a variety of areas of learning in staff development.

Using the cognitive hierarchy can help you plan staff development to help pharmacists developing expertise in problem solving. You begin with the facts, add meaning by relating them to their context, and finally facilitate the manipulation of information in the analysis, synthesis, and evaluation levels. Staff development is inevitably focused on the development of professional competency. Professional competency involves "doing," and "doing" can be learned only through experiential learning (i.e., application, analysis, synthesis, and evaluation). Thus, practice in solving problems should be the main activity of the staff development experience. On the other hand, as is obvious from the taxonomy, pharmacists cannot solve problems if they have not acquired sufficient knowledge and understanding of the content. Although a grasp of the cognitive hierarchy can help you avoid a major pitfall in the role of preceptor—simply conveying more and more information—it can also help you avoid the other extreme—expecting problem solving from a pharmacist who does not have command of the necessary content.

Affective Domain

The affective domain deals with emotions, feelings, or the degree to which the individual accepts or rejects a value or belief. When pharmacists' learning falls into the affective domain, objectives are categorized according to Krathwohl's taxonomy[2] (Figures 9-1 and 9-3). Like the cognitive domain, the affective taxonomy has a hierarchy of learning—in this case, five levels: receiving, responding, valuing, organization, and characterization. To respond to a situation, the pharmacist must first be aware of the situation. Next, he or she must value that experience before organizing or characterizing the value. Krathwohl[2] describes this process as "internalization":

> The process begins when the attention of the student is captured by some phenomenon, characteristic or value. As he pays attention . . . he differentiates it from others present in the perceptual field. With differentiation comes a seeking out of the phenomenon as he gradually attaches emotional significance to it and comes to value it. As the process unfolds he relates this phenomenon to other phenomena to which he responds that also have value. This responding is sufficiently frequent so that he comes to react regularly, almost automatically, to it and to other things like it. Finally the values are interrelated in a structure or view of the world, which he brings as a "set" to new problems.

The following is a definition and an interpretation of each of Krathwohl's levels in pharmacy terms.

Receiving is being aware of and being willing to

Evaluation	Can judge the value of material based on definite criteria Ex: Determines that a proposed set of pharmacotherapeutic goals for a particular patient are appropriate
↑	
Synthesis	Creates something entirely new by putting parts together into a whole Ex: Designs a therapeutic regimen for a patient
↑	
Analysis	Breaks down material into parts to understand its organizational structure Ex: Selects pertinent information from a patient's medical chart upon which to make decisions for pharmacotherapeutic outcomes for that patient
↑	
Application	Uses rules, methods, concepts, principles, laws, or theories in new situations Ex: Calculates a loading dose
↑	
Comprehension	Understands the meaning of new material Ex: Explains the differences between progress notes and treatment orders
↑	
Knowledge	Recalls learned material Ex: Names the parts of a patient medical chart

Figure 9-2. Pharmacy example using Bloom's taxonomy of the cognitive domain[1]

receive stimuli or to give something attention. For pharmacists, it may be first paying attention to individual differences of patients and being willing to accept those differences. It includes the selective attention required to notice the differences.

Responding moves up one level to being acquiescent, showing increased willingness to respond, and deriving increased emotional satisfaction from responding. At this level, pharmacists demonstrate a passive willingness to address the needs of patients who are nonadherent and derive increasing satisfaction from doing so.

Valuing moves from acceptance to interest and appreciation. Enthusiasm and warmth start to categorize behavior at this level. The pharmacist may move as far as preference or commitment. For example, the pharmacist may feel an obligation to work with the terminally ill even though it is emotionally difficult.

Organization is required when the individual must deal with more than one relevant value. Each value is then placed within a system so that each can have its place in the person's life. Acceptance of professional responsibility and acceptance of family responsibility are associated values that must be organized so the pharmacist can maintain responsibility in both areas simultaneously.

Characterization of a value requires the development of a consistent value system. The individual internalizes and organizes values so that his or her response is consistent. Individuals at this level have fully integrated the values into their way of thinking, and thus they act out these values as a way of life.

Figure 9-3 shows how this scheme can be applied to the development of belief in direct patient care. Much of what is learned by a pharmacist who is transitioning to the practice of direct patient care is affective. Attitudes toward work, the concept of direct patient care, compassion for patients, and acceptance of the responsibilities of direct patient care all fall into this domain.

Psychomotor Domain

The psychomotor domain involves motor skills or the manipulation of materials or of objects. All the hands-on activity of preparing medications falls into this category. Simpson's[3] seven-level taxonomy (Figures 9-1 and 9-4) is used to describe learning in this area. As you review this taxonomy, keep in mind the stepwise learning sequence advocated for learning in the psychomotor domain. First the pharmacist

Characterization ↑	Displays the phenomenon as a lifestyle Ex: Practices patient-centered pharmacy
Organization ↑	Forms an internally consistent value system Ex: Integrates principles of direct patient care into own practice
Valuing ↑	Attaches worth to the phenomenon Ex: Studies applications of direct patient care to incorporate it into own practice
Responding ↑	Willingly seeks participation in the phenomenon Ex: Voluntarily attends meeting sessions dealing with direct patient care
Receiving	Pays attention to particular phenomenon or stimuli Ex: Describes the interest of the profession in the concept of direct patient care

Figure 9-3. Pharmacy example using Krathwohl's taxonomy of the affective domain[2]

should be given a full description of how to perform the procedure. Then the pharmacist should observe repeated expert demonstrations of the procedure until he or she can grasp the details of the performance. Next should come practice under supervision until the pharmacist is able to perform the procedure independently.

Figure 9-4 shows this taxonomy applied to the procedure for taking a patient's blood pressure.

Only a few psychomotor skills are listed in the Pharmacy Practice Competency Checklist. Although few, they are critical to the practice of pharmacy and deserve your attention.

You can use Figure 9-5 to practice all you have learned about the taxonomies. Figure 9-5 is a list of educational objectives. Write in the type of learning and the level within that taxonomy for each objective. Refer to Figure 9-1. (Eventually you will get comfortable with the schemes and won't need the figure anymore.)

As you approach the task of writing an educational objective, you will first identify the type of learning you are dealing with—cognitive, affective, or psychomotor. Then you can determine your level of expectation for the pharmacist according to the appropriate taxonomy. This will guide your statement of exactly what you expect the pharmacist to be able to do at the conclusion of the learning experience. If the teachers in the staff development program understand learning in these terms, they can integrate that understanding

Origination	Creates new approach to performance of the skill Ex: Devises a strategy for measuring the blood pressure of a patient with paraplegia
↑	
Adaptation	Modifies performance of the skill to satisfy special circumstances Ex: Obtains an accurate blood pressure reading on hard-to-measure patients
↑	
Complex Overt Response	Performs the skill quickly, smoothly, and accurately Ex: Consistently takes a routine blood pressure within two minutes and without error
↑	
Mechanism	Performs the skill with some confidence and proficiency Ex: Takes a routine blood pressure skillfully
↑	
Guided Response	Performs the skill through imitation, or trial and error Ex: Takes a patient's blood pressure as demonstrated by the preceptor
↑	
Set	Demonstrates mental, physical, and emotional readiness to act Ex: Describes the procedure for taking a patient's blood pressure
↑	
Perception	Relates stimuli to action Ex: Distinguishes correct placement of the blood pressure cuff

Figure 9-4. Pharmacy example using Simpson's taxonomy of the psychomotor domain[3]

Taxonomy Identification Exercise

Taxonomy	Level	Objective
______________	__________	1. Discuss the use of several methods of monitoring and evaluating drug costs.
______________	__________	2. Discuss elements in the history of pharmacy practice that have positively influenced one's own current practice.
______________	__________	3. State the history of residency programs.
______________	__________	4. Act ethically in the conduct of all pharmacy practice activities.
______________	__________	5. Speak clearly and distinctly.
______________	__________	6. Use time management techniques to accomplish job responsibilities efficiently.
______________	__________	7. Design medication use education for patients.
______________	__________	8. Discuss factors to consider in evaluating the medication use educational needs of patients.
______________	__________	9. For each measured parameter in a monitoring plan, interpret the relevance to the desired values.
______________	__________	10. Prepare drug products using appropriate techniques and following the health system's policies and procedures.
______________	__________	11. Prepare intravenous admixtures using aseptic technique.
______________	__________	12. Develop patient care plans to assess, manage, and, where possible, prevent adverse drug reactions.
______________	__________	13. Compare patient-specific adverse drug reaction (ADR) information with that reported in the literature.
______________	__________	14. Integrate documentation into all direct patient care activities.

Answer Key:

1. cognitive, comprehension
2. cognitive, comprehension
3. cognitive, knowledge
4. affective, characterization
5. psychomotor, complex overt response
6. cognitive, application
7. cognitive, synthesis
8. cognitive, comprehension
9. cognitive, evaluation
10. cognitive, application (this statement is so broad that you might well interpret part of it as psychomotor)
11. psychomotor, mechanism (more clearly psychomotor here)
12. cognitive, synthesis
13. cognitive, analysis
14. affective, organization

Figure 9-5. Taxonomy identification practice exercise

into the entire instructional approach, with a profound impact on the effectiveness of teaching.

Writing a Four-Part Educational Objective

What constitutes an educational objective? In preparing an educational objective for staff development, ask, "What pharmacist-learner performance can I measure whose satisfactory completion will assure me that the individual has mastered the learning I want him or her to achieve?" "In what situation will I ask the pharmacist-learner to do this performance?" and "What will constitute success?" A fully developed educational objective has four parts:

1. Who?
2. Doing what?
3. Under what conditions?
4. To what criteria?

Part One answers the question "Who is the performer?" In our case it is always the pharmacist-learner, because that is who is doing the learning. You may have seen objectives that read like this:

- The instructor will demonstrate proper aseptic technique.
- This course will cover the steps in developing a complete drug therapy regimen.

but these are not educational objectives. Rather, they are program or course objectives. To repeat, educational objectives specify what the *learner* will do.

Part Two answers what measurable behavior the pharmacist-learner will perform. There are two rules to observe here. One is that the behavior be expressed as a measurable verb; the second is that the action specified match the type and level of learning you decide the educational objective should reflect. Let's cover the concept of measurability first.

The idea that we will teach people to understand is a favorite of all of us who teach. So what's wrong with stating an educational objective this way?

- The pharmacist will understand the health system's policies and procedures for documenting patients' drug refills.

How do you measure a person's understanding? Do you observe a light shining from within when you bring up the topic of work documentation? Do you zip open the pharmacist's head and look inside for the "understand compartment"? No, but you could measure the pharmacist's understanding by requiring him or her to explain those policies and procedures. So a properly worded answer to *Doing what?* could be:

- The pharmacist will explain the health system's policies and procedures for documenting patients' drug refills.

Appreciate is another favorite word that is also forbidden. You are going to have a difficult time measuring if you choose to write:

- The pharmacist will appreciate the need to stay current with drug therapy literature.

What can you measure here—the pharmacist's blood pressure when you mention a relevant article? You may have more success if you try this:

- The pharmacist will adhere to a plan for staying current with drug therapy literature.

Now you can require the development of a plan and a log of activities. Appreciation is demonstrated by action.

The point is that the verb you select for an educational objective must represent a quantity you can measure. Words like *appreciate, understand, learn, comprehend,* and *know* are not useful because they are not measurable. Words like *revise, systematize, plan, select, explain, write, compute,* and *operate* are useful.

The second consideration is locating the behavior within the taxonomies of learning. Once you have the behavior categorized, you must select a verb that matches the level of learning and specifies an appropriate and measurable action. Gronlund[4] is a reference for selecting verbs for each of the respective taxonomies. Here is a quick list that may be all you need:

Knowledge: define, describe, list, state
Comprehension: explain, give examples of, predict
Application: compute, demonstrate, solve, use
Analysis: differentiate, discriminate, point out, select
Synthesis: design, formulate, modify, write
Evaluation: appraise, compare, explain, justify

Part Three specifies the givens and constraints under which the pharmacist must perform the action of the educational objective. You may want to give your pharmacist-learner full access to references and specify the particular patient, as in the following:

- Given standard reference materials and a patient's medical chart, the pharmacist will determine laboratory values for a patient that are not in the normal range.

Or you may want to evaluate the pharmacist's performance in a controlled situation rather than in the hurly-burly of regular practice. In that case you might include a condition like the following:

- Given a simulated patient exhibiting chest pains, the pharmacist will follow established procedures for obtaining a medical history in a potential medical emergency situation.

Part Four states qualitative standards for the performance—how well the pharmacist must do it. You can easily insert criteria into one of the educational objectives just created:

- Given standard reference materials and a patient's medical chart, the pharmacist will determine laboratory values for a patient that are not in the normal range, with 90 percent accuracy.

Here are more examples of criteria:

- Label drug products *in accordance with the health system's policies and procedures.*
- Devise efficient strategies for one's own direct patient care activities *that maximize the delivery of appropriate direct patient care to each patient.*

It makes good sense to write the level of learning before each objective statement. If your goal is to communicate your exact intent as clearly as possible, placing the level of learning in parentheses before the educational objective leaves no doubt about the type or level of learning. The reader then simply has to decipher the nature of the performance, conditions, and criteria.

Writing Educational Objectives for a Pharmacist's Training Program

The writing of objectives for individuals in your staff development program should begin with the Pharmacy Practice Competency Checklist. Note that the skills on the checklist are really educational objectives—statements of observable, measurable behaviors—helping to make it possible to assess pharmacists' abilities to perform the skills. For example, task 2.1.1 in the checklist is a cognitive educational objective at the analysis level—collect and organize all patient-specific information needed by the pharmacist to prevent, detect, and resolve medication-related problems and to make appropriate medication therapy recommendations. This is an end-point behavior for the pharmacist.

If you have a pharmacist who does not yet have the skills to build the patient information base, we have suggested that the Staff Development Task Force confer to identify what the pharmacist needs to know that he or she does not already know to be able to do the task. The results of that discussion, a learning analysis, produce a subcategory of objectives that we might call instructional objectives. This is because they specify instruction that must occur to assist the pharmacist-learner in mastering the end-point educational objective. These objectives are worded and classified in exactly the same way as the end-point objective. Some instructional objectives that might be identified for the creation of a patient-specific information base follow:

- *Comprehension:* Identify the types of information the pharmacist requires to prevent, detect, and resolve medication-related problems and to make appropriate drug therapy recommendations.
- *Comprehension:* Explain signs and symptoms, epidemiology, risk factors, pathogenesis, natural history of disease, pathophysiology, clinical course, etiology, and treatment of diseases commonly encountered in your health system.
- *Comprehension:* Explain the mechanism of action; pharmacokinetics; pharmacodynamics; pharmacoeconomics; usual regimen (dose, schedule, form, route, and method of administration); indications; contraindications; interactions; adverse reactions; and therapeutics of drugs in your health system's formulary.

Instructional objectives become your guide for determining what content the pharmacist must learn and what instructional methods are appropriate for teaching it. The selection of instructional methods is the topic of Chapter 10.

Assessing the Pharmacist-Learners' Mastery of Training Objectives

When the training is over, you will want some assurance that your pharmacist-learners have mastered their educational objectives. Before focusing on some specifics on assessing achievement, let's consider the importance of determining the detailed assessment strategy before designing instruction. That may sound a little odd. Most of the teachers who are our role models first decide on the objectives, next deliver instruction, and then write the test the night before the exam. Why do we suggest a change in order?

Design Assessment First

The emphasis in writing objectives is to be clear about what behavior you expect from the pharmacist-learner when the training is over. When you "sit with" an objective and ponder the kind of activity it specifies so that you can translate that activity into an evaluative situation, you are forced to consider in depth what the objective really means. This leads to a better understanding of how to structure instruction to see that the objective is achieved. For example, let's take the inventory skill "Design a pharmacotherapeutic regimen, including modifications to existing drug therapy, that meets the pharmacotherapeutic goals established for a patient." How will you measure the achievement of this goal? The word *design* tells you that this is a synthesis-level objective. Clearly, then, the pharmacist is going to have to create something—a regimen. The only way to test this objective is to challenge the pharmacist to design a medication regimen and evaluate its quality. Having the pharmacist write about or talk about the steps in designing a regimen is not enough. That would be knowledge or comprehension-level testing. Going through this exercise makes you think about what learning situation will enable mastery of the objective. It tells you that assigned reading and lectures can build the knowledge the pharmacist needs for designing medication therapy, but only experience in designing regimens will allow him or her to practice the skills you will ultimately evaluate.

Almost all the Pharmacy Practice Competency Checklist skills are at the application level or above. That means that to assess their achievement you must have the pharmacist "do something," and the something has to be whatever activity is specified in the objective. On the other hand, you may identify instructional objectives that will help the pharmacist achieve the educational objective that are at the comprehension level. These instructional objectives can be assessed through discussion or objective testing. If ultimately the pharmacist-learner is going to be asked to "talk about" rather than "do," then instruction need not involve "doing." As you proceed with training, you may frequently use discussion or objective testing as assessment methods. They are appropriate for assessing knowledge and comprehension and will help show where the learner is in building the foundational knowledge and skills necessary for the ultimate skill performance. Keep in mind, however, that at the end of training, you will want to test for performance, and performance means doing. Chapter 7 provided you with full instruction on designing appropriate assessment situations.

Summary

Accurate, well-worded educational objectives are critical to instructional design for staff development. They specify the end point for the learner. Instructional objectives specify learning required to support achievement of the end-point educational objectives. Both types of objectives are worded and classified the same way. Both should describe observable and measurable behaviors and both should be classified according to one of the learning taxonomies—cognitive, affective, or psychomoter—to guide for choosing content and instructional methods.

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Chapter 10
Developing Training Materials and Programs: Facilitating Learning in Staff Development

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Chapters 7 and 9 prepared you to write sound objectives and to assess progress toward their achievement. There is a third activity that, as the staff development coordinator, you must link to your objective writing and the approach you take to assessment. That activity is, of course, instruction. Understanding instructional issues will help you whether you are evaluating an existing program or designing your own instruction.

As you learned in Chapter 9, your pharmacists may need training in all three learning domains—cognitive, affective, and psychomotor. You also found that within each domain's taxonomy there are different levels of learning and that learning in any of the three is hierarchical. Using your clearly stated and classified objectives will help you shape effective and efficient instruction. Frankly, you can't afford to waste your staff's time, so it makes sense to seek training that zeroes right in on what they need. You need the right tools, appropriate teaching methods, and techniques that match the methods to accomplish the job. It's a lot like the thinking you must do when

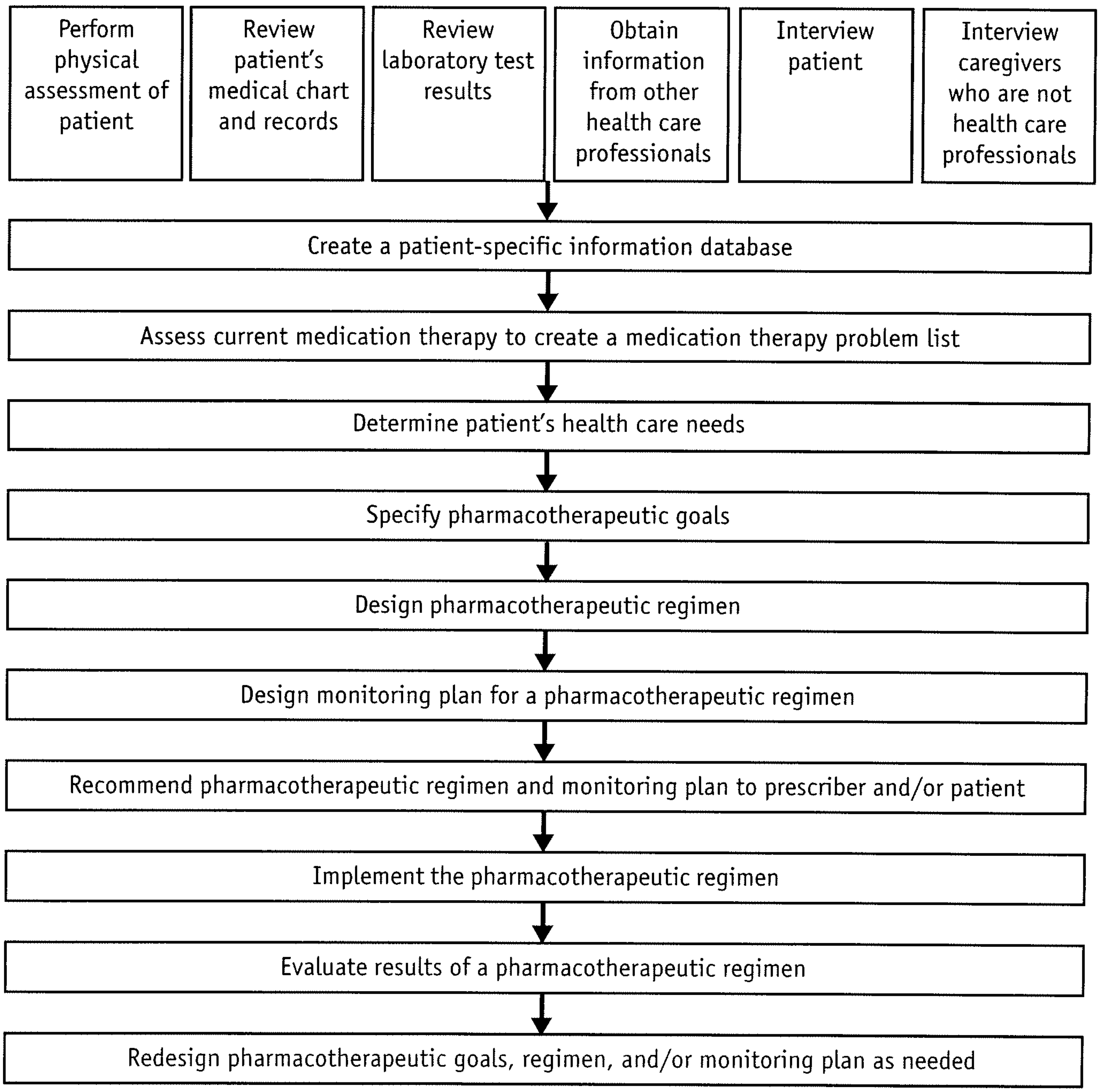

Figure 10-1. Flow of decisions for designing, recommending, monitoring, and evaluating patient-specific pharmacotherapy

you get a request for drug information. First, you work at a clear understanding of the requester's need, then you use your knowledge of the literature and the way it is organized to select the most likely resources. If you don't know your drug information resources, you will spend a lot of extra time answering the request. Likewise, if you don't understand the instructional methods and techniques available to you and the taxonomies and levels of learning for which they are appropriate, you may waste a lot of your staff's time.

Most of the learning your pharmacists will need to enhance their direct patient care skills is cognitive. Therefore, this chapter focuses on methods and strategies that are suited to cognitive learning.

A Framework for Experiential Teaching

Professional Competency: The Goal of Staff Development

The goal in staff development will always be performance. What would be nice to know has to take a back seat to what one needs to know. For example, knowing everything there is to know about disease states is useless if that knowledge cannot be translated into the design of an effective pharmacist's care plan. Memorizing a list of basic poison references is useless if the pharmacist cannot find the proper antidote when a toddler swallows his father's theophylline.[1] Does that mean that in staff development we dispense with teaching about disease states and poison references? Most emphatically, no! The discussion of professional competency in Chapter 7 clearly establishes that a pharmacist cannot solve patient care problems without the possession of both content matter and procedural knowledge.

To be professionally competent in today's pharmacy practice is to be a highly skilled problem solver. Think about the work of direct patient care. One individual after another parades through the pharmacist's arena. Each individual is different, and that individuality tends to throw even a seeming textbook case slightly askew. As a consequence, the professional life of the pharmacist involves fitting together multiple confounding factors to find creative solutions to drug therapy problems.

Pharmacists' Methodologies for Solving Practice Problems

Two areas of practice responsibility are critical to providing direct patient care. One is designing, recommending, monitoring, and evaluating patient-specific pharmacotherapy; the other is responding to requests for patient-specific drug information. Task analysis of these two areas pro-

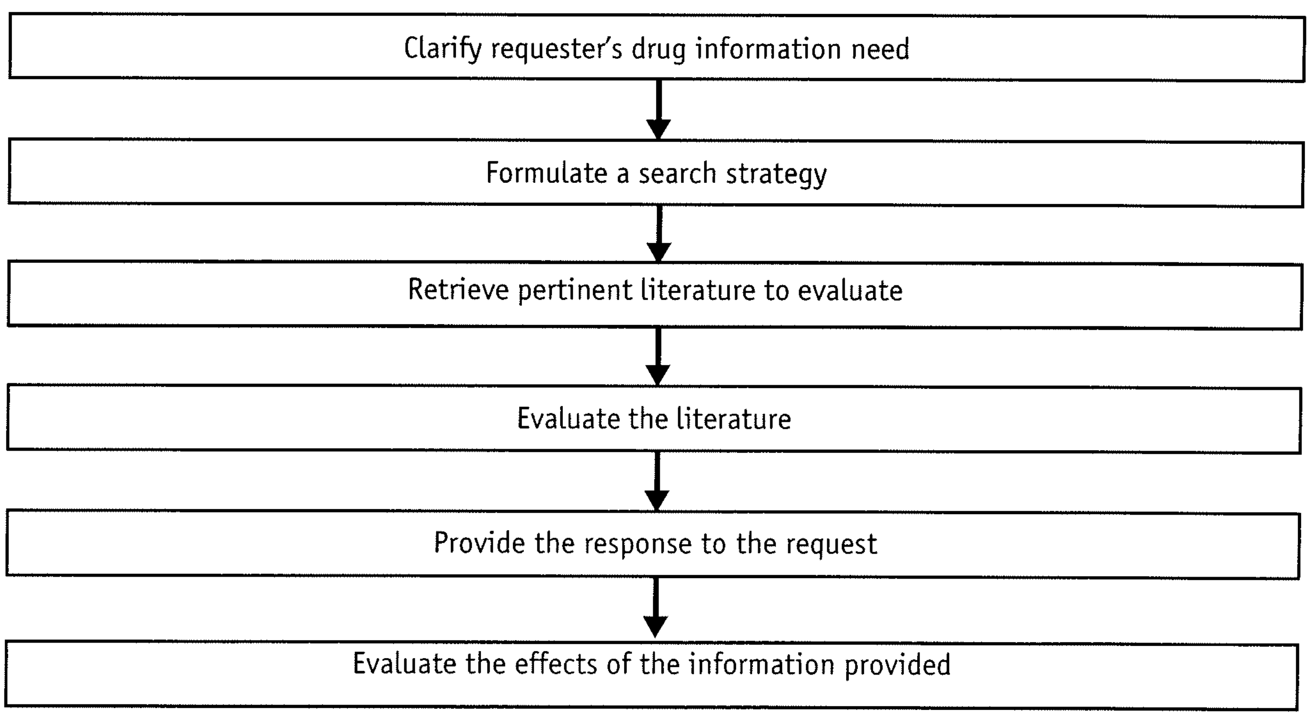

Figure 10-2. Flow of decisions for responding to requests for patient-specific drug information

Table 10-1. Developing Skill in Designing, Recommending, Monitoring, and Evaluating Patient-Specific Pharmacotherapy

Goal: Design, recommend, monitor, and evaluate patient-specific pharmacotherapy.

Objectives:

(Synthesis) Collect and organize all patient-specific information needed by the pharmacist to prevent, detect, and resolve medication-related problems and to make appropriate medication-therapy recommendations.

(Analysis) Determine the presence of any of the following medication therapy problems in patient's current medication therapy:

1. medications used with no medical indication
2. medical conditions for which there is no medication prescribed
3. medications prescribed inappropriately for a particular medical condition
4. incomplete immunization regimen
5. anything inappropriate in the current medication-therapy regimen (dose, dosage form, duration, schedule, route of administration, method of administration)
6. presence of therapeutic duplication
7. prescription of medications to which the patient is allergic
8. presence or potential for adverse drug events
9. presence or potential for clinically significant drug-drug, drug--disease, drug-nutrient, or drug-laboratory test interactions
10. interference with medical therapy by social, recreational, OTC, or nontraditional medication use
11. patient not receiving full benefit of prescribed medication therapy
12. problems arising from financial impact of medication therapy on the patient
13. patient lack of understanding of his/her medication therapy
14. patient not adhering to medication regimen
15. prescribed medication is not available as a pharmaceutical grade product

(Synthesis) Using an organized collection of patient-specific information, summarize patients' health-care needs.

(Synthesis) Specify pharmacotherapeutic goals for a patient that integrate patient-specific data, disease-specific and medication-specific information, and ethical and quality-of-life considerations.

(Synthesis) Design a pharmacotherapeutic regimen that meets the pharmacotherapeutic goals established for a patient; integrates patient-specific disease and medication information, and ethical and quality-of-life issues; and considers pharmacoeconomic principles.

(Synthesis) Design monitoring plans for pharmacotherapeutic regimens that effectively evaluate achievement of the patient-specific pharmacotherapeutic goals.

(Application) Recommend pharmacotherapeutic regimens and corresponding monitoring plans to prescribers and patients in a way that is systematic, logical, and secures consensus from the prescriber and patient.

(Analysis) For a given patient, determine the appropriate route of administration and device for administering a parenteral or enteral fluid or medication.

(Application) When appropriate, initiate the pharmacotherapeutic regimen according to the health system's policies and procedures.

(Application) When appropriate, order tests required by the monitoring plan according to the health system's policies and procedures.

(Analysis) Accurately interpret the meaning of each parameter measurement.

(Synthesis) Modify a pharmacotherapeutic plan as necessary, based on evaluation of monitoring data.

duces the flow diagrams shown in Figures 10-1 and 10-2. The sequence of decisions in these diagrams represents the thought processes most pharmacists report they use when providing direct patient care to patients. Tables 10-1 and 10-2 translate the decision points in each of the two problem-solving processes into educational objectives that can be used to (1) focus training and (2) guide assessment procedures to evaluate pharmacists' ability to deliver these two aspects of direct patient care. These educational objectives are the mainstay of the Pharmacy Practice Competency Checklist job responsibility areas 2 and 3.

The effective staff developer can use this knowledge of a systematic and orderly process for pharmacist problem solving to assess practitioners' skills and as a guidepost for designing training in the skills they lack. The most efficient and effective learners are those who are aware of this flow of decision-making. This is because they can use that knowledge to help systematize their problem solving and direct their own learning.

Using Short- and Long-Term Memory

Just as we use theoretical models to help us visualize and understand the action of drugs in the body, we can use a model to help us visualize what goes on in the mind when we learn. The computer is the dominant metaphor to explain how we acquire, retain, and use knowledge.[2] Figure 10-3 presents a highly simplified model. When we pay attention to a stimulus, it enters our consciousness or short-term memory. If the mind chooses to retain the information, the mind must encode it. This in effect means giving the information an address to which it will be sent in long-term memory. The processing of information, which includes problem solving, occurs in the flow of information into working memory and back out to long-term memory.

Short-term memory, then, is where all the work takes place. But, unlike long-term memory, which appears to have unlimited capacity, short-term memory is limited to holding five to seven pieces of information at a time. Its limited capacity can be increased by "chunking."[3] Chunks are created when the mind perceives pieces of information as related to one another and sends them to the same address. The aggregate information is recalled as one unit or chunk.

The efficiency with which pertinent information can be remembered, and thus retrieved from long-term memory for work on solving a problem, depends on the address to which the information was sent. To understand this principle, you need to understand how information is stored in long-term memory. Knowledge is stored in what cognitive psychologists refer to as schemata, which we can visualize as trees. The encoding process sends information to a particular tree. The choice of which tree and which branch on that tree is determined by the content of the new information and its relationship to other pieces of information in long-term storage.

For example, if a pharmacy student in an anatomy course learns a new piece of information about valves in the heart, that information will probably be stored on a tree encoded *heart* on the branch labeled *valves*. The address will be different if the student acquires

Table 10-2. Developing Skill in Responding to Requests for Patient-Specific Drug Information

Goal:	Provide concise, applicable, and timely responses to requests for drug information from health care providers and patients.
Objectives:	
	(Analysis) Accurately identify the requester's drug information need.
	(Synthesis) Formulate a systematic, efficient, and thorough procedure for retrieving drug information.
	(Analysis) Determine from all retrieved biomedical literature the appropriate information to evaluate.
	(Evaluation) Evaluate the usefulness of biomedical literature gathered.
	(Synthesis) Formulate responses to drug information requests based on analysis of the literature.
	(Evaluation) Assess the effectiveness of drug information recommendations.

the same information while working on a cardiac case. Say he determines that in order to decide whether the patient is at risk for thrombic formation he must know more about valves. In this case, the valve information is stored on the tree that deals with cardiac cases of potential thrombic formation, because the student acquired the knowledge while working on that type of case. In other words, he has developed strong relationship lines between valves and cases dealing with potential thrombic formation.

An interesting feature of long-term memory is that the organization of the schemata trees is not like a forest with individual trees separated from each other. Instead, as depicted in Figure 10-4, the branches of different trees are connected by their relationships of content to form a huge network. That is why when you can't recall something directly, you can sometimes browse through your memory and get at it indirectly.

The act of processing information can be controlled or automatic.[4] Controlled processing requires the individual's attention. Only one process can go on at a time, and it uses up short-term memory capacity. Automatic skills are things like walking, riding a bike, or solving certain aspects of clinical problems that have become so routine that the pharmacist doesn't think about them while doing them. Automatic processing uses little short-term memory and happens when short-term memory recognizes a certain input and activates a sequence without the individual's conscious control. A person's capacity for automatic processing increases with training and practice. In turn, the capacity to solve problems increases when the routine elements of solving a problem are automatized and controlled processing is free to concentrate on the novel aspects of the problem.[5]

Defining a Problem

A problem may be thought of as a situation that is in some state, that one wishes to have in another state, but for which there is no direct or obvious course of action to achieve the change.[6] Thus, when a pharmacist must deal with a patient's pain and concurrently consider the patient's allergies, anxieties, and resistance to oversedation, the pharmacist must solve a problem or a series of problems.

Problems have four components: (1) a goal or goals; (2) givens, which are what you have available as you start to solve the problem; (3) obstacles; and (4) procedures that you may use to solve the problem.[7]

Another important perspective on the nature of problems is Simon's[8] differentiation between well-structured and ill-structured problems. Well-structured problems are the types of problems posed to students in pharmacy schools. Well-structured problems can be put into words, and they can usually be solved by applying a series of

Table 10-3. Guide to Selecting Techniques for Instruction for Cognitive Learning

STAGES OF LEARNING IN THE FRAMEWORK OF INSTRUCTIONAL STRATEGIES	BLOOM'S LEVELS OF COGNITIVE LEARNING	APPROPRIATE INSTRUCTIONAL METHODS
Foundation Knowledge and Skills	Knowledge	Reading Lecture
	Comprehension	Guided Discussion Interactive Lecture
Practical Application	Application	Case Presentation Case-Based Teaching Simulation/Role Play Practice-Based Teaching
	Analysis	
	Synthesis	
Culminating Integration	Evaluation	

known steps (an algorithm). As an example, consider the adjustment of a dose of gentamicin in a patient with worsening renal failure. The pharmacist goes through a three-step algorithm to solve the problem: (1) determine the patient's age, weight, and serum creatinine level; (2) calculate the patient's creatinine clearance; and (3) calculate the dose adjustment.

Ill-structured problems, on the other hand, are what pharmacists most often see in practice. The statement of the problem may be vague and fuzzy. The problem is more complex, and the criteria for determining that it is solved are less definite. The problem situation does not include all the information necessary to solve the problem, and there is no simple set of actions that will ensure a correct answer. For example, consider a patient with pneumonia who has failed to respond to the prescribed antibiotic regimen. An algorithmic solution is not feasible because the set of information needed to solve the problem is vague. Where is the infection? Can the chosen antibiotic get to the infection? Was the infection acquired in the hospital? If so, the organism may be resistant. Finally, has the right drug been used (i.e., is the organism sensitive to this drug)?

Solving a Problem

The first step in solving a problem is representing the problem in the mind.[9] Here the importance of perception comes into play. The problem has an objective reality, which the pharmacist may or may not perceive. Whatever the pharmacist perceives as the problem is what will be represented in the mind, and that is the problem that will be solved.

Why so much concern about framing the problem? It is because the mind uses the problem statement to circumscribe the areas in which all information bearing on the problem—as defined by the pharmacist—is stored. This is called the problem space.[10] This space is the realm the pharmacist can search until he or she finds the situation that is the solution to the problem. If the statement of the problem is vague, the problem space will be larger than if the statement is narrow and focused. The bigger the space to be searched, the longer it may take to find a solution.

Next, based on the problem statement, the pharmacist's mind selects strategies for solving the

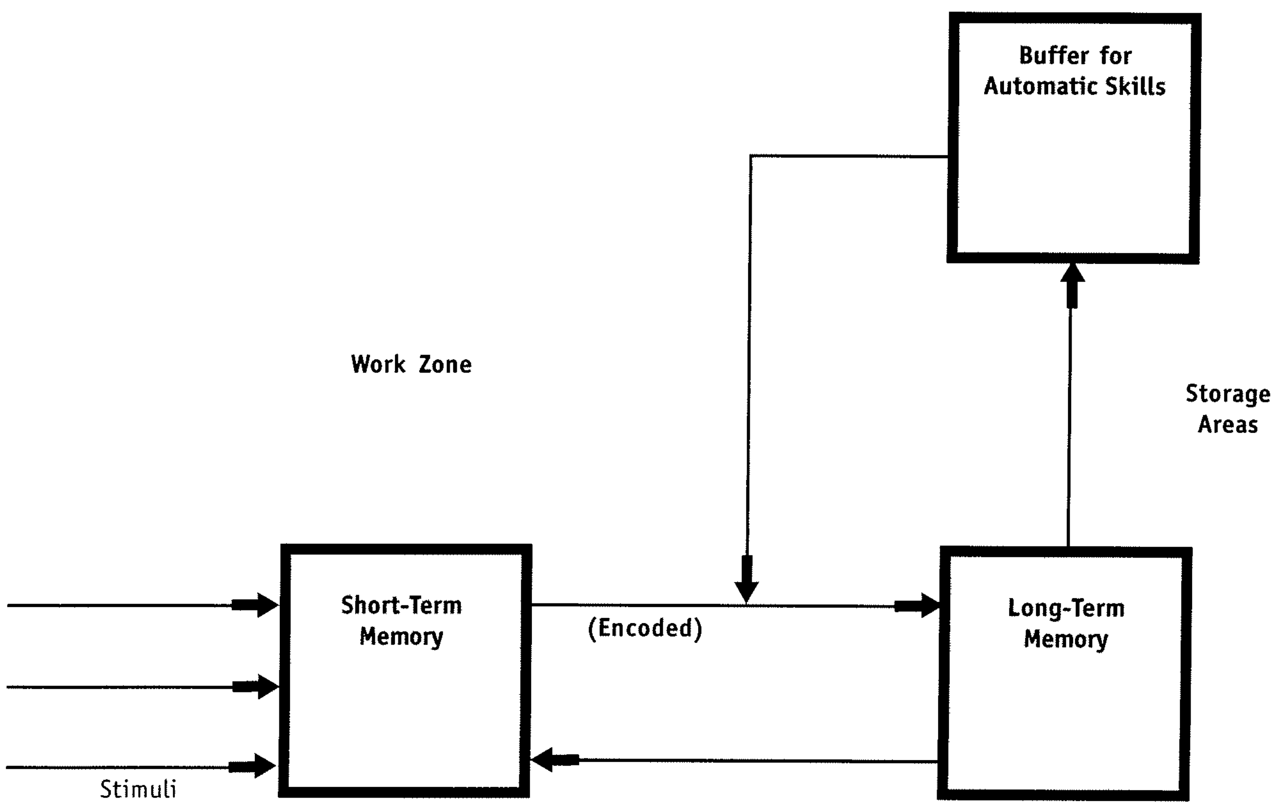

Figure 10-3. Cognitive information processing (CIP) view of the mind

problem. Using these strategies, the mind moves within the problem space in its search for a solution. Experience with using a particular strategy or its variants may affect the efficiency with which pertinent strategies are selected and ineffective strategies are discarded.

In the final step of solving the problem, the pharmacist evaluates whether the solution has been reached. This is generally an incremental process, since solving most pharmacy problems is a multistep process.

There are three key points to keep in mind. First, the problem statement in the pharmacist's mind is the problem he or she will solve. Second, based on the problem statement, the mind selects the pertinent information to use in finding a solution. Too broad a problem statement means the solution process may be slowed down. An inaccurate problem statement means access to the wrong information and a wrong solution for the actual problem. Finally, all the content information in the world won't be enough if the pharmacist doesn't know pertinent problem-solving strategies. If you think for a moment about the components of problem-solving skill in the Professional Competency Equation discussed in Chapter 7, you will see the link between the equation and how the mind solves problems. Both *what* and *how* have to be in place to do the job.

Characteristics of Skilled Problem Solvers

As a staff developer, your task is to enhance the problem-solving skills of your colleagues. Now, as the final stop in this voyage through cognitive psychology, let's take a look at what your pharmacists' minds will be like when you have completed your task.

If you could peer inside the head of a pharmacist who is skilled in solving direct patient care problems, you would observe three things. First, he or she has

Figure 10-4. Schemata for a three-dimensional network

highly developed schemata storing a wealth of direct patient care–specific knowledge. This is the *what*. Second, he or she has basic problem-solving strategies for a wide range of problems and many variations on each of the basic strategies. This is the *how*. Finally, his or her schemata are highly organized so that she can access her knowledge through a network.

Now that you know the overall picture, the following detailed list of the characteristics of a skilled problem solver will have context. The source of the first six characteristics is the work of Glaser and Chi,[11] who have studied the development of expertise by examining differences between experts and novices. The discussion in this book is about the development of skill, not expertise. However, skill and expertise are connected on a continuum as one moves through professional growth from novice to expert. The final two characteristics on the list are the result of the author's reflection on the special nature of the practice of direct patient care.

1. *Skilled problem solvers see meaningful patterns in the problem space they create to solve a problem.* For example, when called on to make a decision about dosing, the skilled pharmacist integrates properly weighted patient specifics with drug and disease information.
2. *Skilled problem solvers can retrieve needed information quickly.* Information in the pharmacist's long-term memory has been organized and stored on the tree devoted to information and strategies for solving a particular type of problem. It is, therefore, immediately accessible when needed.
3. *Skilled problem solvers are good at basic patient-care-related problem solving.* Routine aspects of problem solving have been automatized and placed in the buffer for automatic skills. The pharmacist simply accesses the problem-solving routine without having to occupy space in short-term memory.
4. *Skilled practitioners frame their statement of the problem at a deep, principled level.* The pharmacist goes beyond the surface features of a problem to define it on the basis of principles and inferences. Most often he or she will view the problem as a variation of a category or type of problem.
5. *Skilled practitioners take time to evaluate and frame the problem before trying to solve it.* With experience, the pharmacist has learned that the problem he or she frames in his or her mind is the problem he or she will solve.
6. *Skilled practitioners have strong self-monitoring and metacognitive skills.* Metacognition refers to thinking about thinking. When a pharmacist can describe his or her pattern of thinking when he or she solves a particular type of problem, he or she is displaying an awareness of his or her metacognitive processes. Pharmacists with strong skills in this area can judge their progress in solving a patient care problem and can determine when a case is beyond their expertise.
7. *Skilled practitioners have a high tolerance for ambiguity.* From experience, the pharmacist has learned the necessity of making decisions based on incomplete data and how to live with this necessity.
8. *Skilled practitioners apply contextual knowledge to their decisions on what to do and how to do it.* The pharmacist exercises acute judgment on, for example, how to approach a surgeon versus a pediatrician, or when to push a physician a little further and when not to.

The Professional Competency Equation illustrates that skill in problem solving rests primarily in the problem-solving and judgment components of the equation. As the staff developer, however, you cannot afford to overlook the issue of professionalization, the acquisition of the values and attitudes associated with the profession of pharmacy and, in particular, with the provision of direct patient care. For a discussion of this important component of professional competency, see Pierpaoli.[12]

An Overview of Instructional Strategies

Now that you understand the components of professional competency, the critical role of problem solving in direct patient care, and how people solve problems, you have the foundation for a discussion of teaching strategies. The end goal of your staff development effort is to enhance the skills of your pharmacists in some specific areas of practice so that they are skilled problem solvers who exercise clinical judgment and embody the best of professionalism. If we focus on problem-solving skills and judgment in their use in the Professional Competency Equation, then we can establish a framework of instructional strategies for teaching problem solving, shown in Figure 10-5. (The seminal idea for the Learning Pyramid was presented as a handout by Georgine Loacker, Ph.D., of Alverno College in Milwaukee, Wisconsin, at a symposium entitled "Performance Assessment Across the Educational Spectrum: What Can We Learn From Each Other?" at the Annual Meeting of the American Educational Research Association, Atlanta, GA, April 14, 1993.) This diagram captures the learner's progression to skill in problem solving and the preceptor's role in furthering that goal. To study this progression we begin at the base of the pyramid.

Foundation Knowledge and Skills

One cannot solve a problem without the content understanding the mind needs to draw on in its search for a solution. This content is made up of discrete learnings from the various disciplines that contribute to pharmacy practice. This is knowledge of what *is*, a state we can refer to as the *what*. Content acquisition occurs primarily in pharmacy schools as students build background in the basic sciences, physiology, therapeutics, etc. When you organize a lecture on a disease state or a new drug therapy as part of a staff development program, you are extending your pharmacists' content base. The proper teaching strategy for content is direct instruction.

Practical Application

In this stage the pharmacist-learner moves from understanding to doing. You will recall the distinction between these two levels of learning from the discussion of Bloom's taxonomy in Chapter 9. At the comprehension level of learning, a person can talk about how to do something but cannot actually do it. Doing occurs at the next level, application. Two types of teaching strategy—modeling and coaching—help the pharmacist-learner move to this level. In the first, the preceptor models problem-solving behavior. The preceptor solves one or more patient cases, talking about his or her thinking process as it unfolds so that the pharmacist-learner hears the preceptor's strategy, how he or she makes decisions, and in what order. The preceptor's strategy becomes the model that the pharmacist-learner tries to emulate in the second stage of practical application, in which the preceptor steps aside and coaches the pharmacist-learner through similar problems, providing feedback as the pharmacist-learner moves through the cases. As the pharmacist-learner gets better at applying the problem-solving strategy, the preceptor gives less feedback, since the ultimate goal is for the pharmacist-learner to provide his or her own.

At any point in the modeling and coaching phases, the preceptor or the pharmacist-learner may discover the need for more content knowledge. The need reveals itself in the pharmacist-learner's inability to understand the modeling of strategy or to retrieve the content needed to solve a particular problem. In

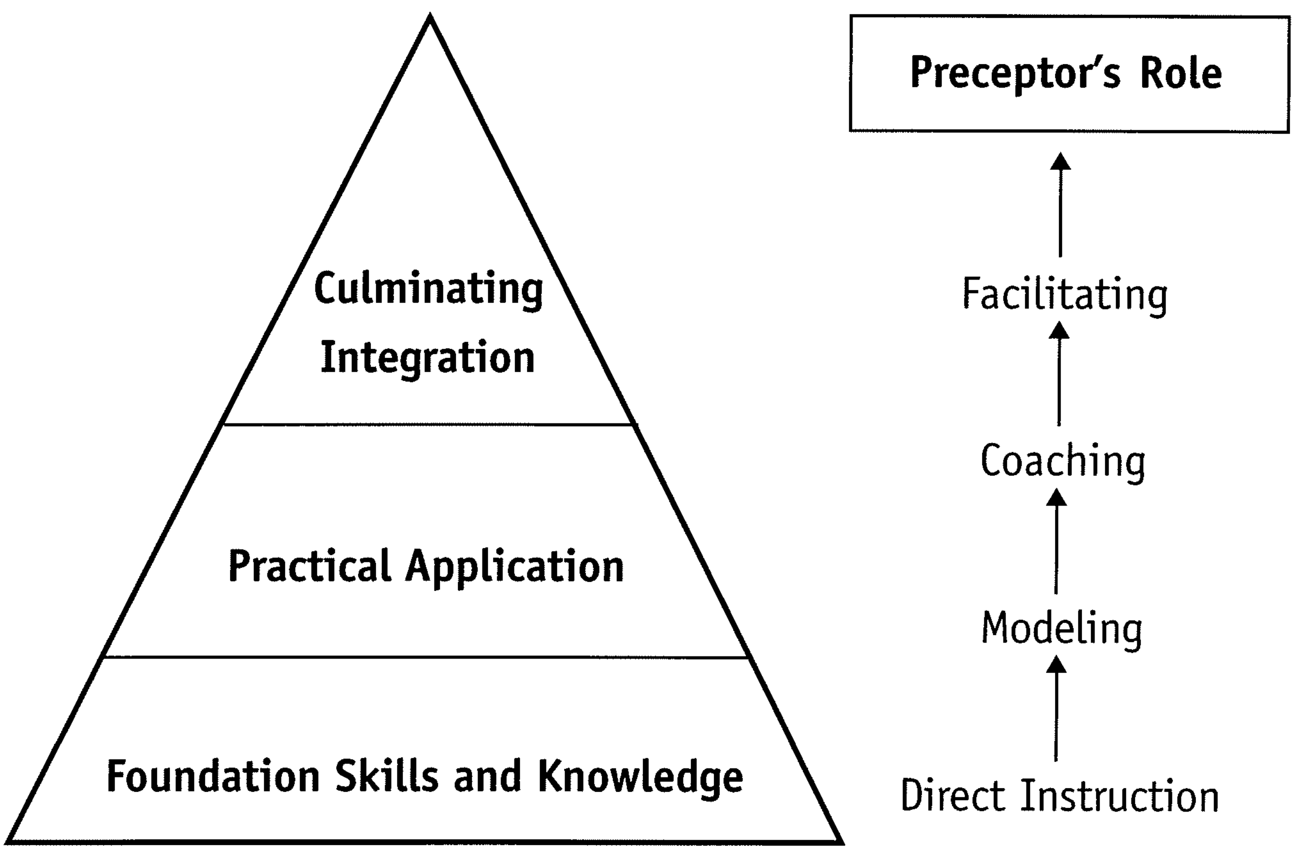

Figure 10-5. The learning pyramid

those moments the role of the preceptor reverts to direct instruction.

Culminating Integration

Now the pharmacist-learner moves toward putting together strategic content and procedural knowledge into an independent problem-solving process that takes place in real-life learning situations. The preceptor's role shifts to deciding what cases the pharmacist-learner is ready to solve and acting as a resource if the pharmacist-learner cannot solve the problem alone. The end of this stage is the goal of the instructional process.

Matching Teaching Strategy with Learning Outcome

Remember that this chapter focuses on how to teach the cognitive skills of problem solving and the judgment associated with them. Some methods, such as demonstration, are not discussed, because such methods are most effective in teaching psychomotor rather than cognitive skills.

The first two columns of Table 10-3 depict the relationship between the three stages of the learning pyramid and the six levels of learning in Bloom's taxonomy. You can use that relationship to select appropriate teaching methods. A pharmacist who acquires foundation knowledge and skills is learning at Bloom's knowledge and comprehension levels. At the pyramid's stage of practical application, the pharmacist is learning at Bloom's application, analysis, and synthesis levels. The culminating integration level of the pyramid involves Bloom's evaluation-level learning. The far right column of Table 10-3 lists appropriate teaching methods for each of the levels of learning. Note that the same four methods are used for both the practical application and culminating integration levels of the pyramid and thus are the methods of choice for application, analysis, synthesis, or evaluation levels of learning. The following is a detailed discussion of the characteristics and application of each of the suggested methods.

Reading

Reading texts, journal articles, and other informational materials tends to be the most effective and flexible way to learn new facts and information. Professionally published materials offer the advantage of organization and clarity of expression. If they are readily accessible, the reader can choose when and where to read them. Further, when a person reads, it's easy to re-read confusing material, a feature that accommodates individual learning differences. However, there are three possible disadvantages to using the printed word for knowledge-level learning. First, as a stand-alone activity, reading offers no recourse for clarification when the material is not understood. Second, while journal articles are at the cutting edge of evolving knowledge, textbooks are not. Third, there may be nothing published that exactly meets the learning need, and as a consequence, the staff development coordinator may have to write customized material, a time-consuming process.

Lecture

The lecture is a formal talk and, like reading, a form of one-way communication. It is useful to convey new facts and information. A well-prepared and timely lecture offers two potential advantages over reading. First, the lecturer can sort through and distill the significant literature, saving the learner's time. Second, lectures can be current with research. On the down side, not everyone lectures well, so some presentations are disorganized or boring. Getting speaker and audience together introduces logistics problems.

Guided Discussion

Guided discussion is the first of two instructional methods appropriate for comprehension-level learning. Both methods require the learner to have mastered the subject at the knowledge level. Both also require interaction between the learner and the instructor.

In guided discussion the instructor poses carefully framed questions to a group of pharmacists to stimulate thinking that builds their understanding of the content. Learners are encouraged to put ideas into their own words, draw analogies with other concepts and ideas, generalize, infer, predict, and identify similarities and differences among concepts and ideas. A strength of guided discussion is its simplicity. Disadvantages include the logistics of getting people together and the need for an instructor skilled in questioning techniques.

Interactive Lecture

The interactive lecture uses two-way communication to open the opportunity to learn at the comprehension level. The interactive lecture combines the characteristics of the lecture and the guided discussion in that the lecturer intersperses the presentation of new material with carefully crafted questions that promote thinking at the comprehension level. This technique gives learners freedom to ask questions when points are unclear. Interactive lecture shares both the advantages and the disadvantages of lecture and guided discussion.

Case Presentation

With case presentation we move to methods that facilitate all learning above the acquisition of knowledge and skills at the comprehension level. Each of these methods assumes that the learner is already at comprehension level for the material to be learned.

In the case presentation, a pharmacist skilled in problem solving presents a patient case he or she has solved, talking through the thought process that led to the solution. The learners ask questions to clarify their understanding of the problem-solving process. An effective case presentation is a technique for modeling problem-solving strategies that learners can emulate as they advance to practicing with feedback. One advantage of case presentations is that they are likely to be interesting. Selecting the right case is always an issue, but the biggest problem with case presentation is the difficulty most practitioners have describing their own problem-solving process. As a novice, the practitioner went through a sequential and identifiable process in solving a medication therapy problem, but as expertise grew, many of the steps in problem solving were collapsed into an automatic routine of which the experienced practitioner is no longer consciously aware. When asked to illuminate those steps for novice learners, the practitioner may find it almost impossible to retrieve those long-ago-collapsed, step-by-step processes or may assume that the process is not step by step but rather intuitive — "I just follow my gut."

Case-Based Teaching

Case-based teaching uses a well-developed case to challenge the learners' decision skills at critical junctures. The instructor skilled in case-based teaching knows case development, is cognizant of the factors surrounding each problem-solving process involved, is aware of where the decision points are, and is highly skilled in flexible questioning techniques that explore learners' thinking processes and stimulate their thinking at the application, analysis, and synthesis levels. Case-based teaching offers significant opportunities for learners to mentally engage in the problem-solving process in an environment that does not put patients at risk. Chapter 11 teaches how to develop and deliver case-based instruction.

Simulation and Role Play

Simulations and role playing, like case-based teaching, offer no-risk environments in which the pharmacists can gain experience in the tasks of direct patient care. Simulations can be of cases, requests for drug information, or any number of practice management problems. Similarly, role plays can be designed for a wide range of practice situations. One advantage of these methods is the chance to build in a sense of urgency that reflects the pace and conflict of real-life practice. A disadvantage is the need for instructor skill in setting up and running the simulation or role play.

Practice-Based Teaching

The methods suggested for the practical application and culminating integration stages of learning have gradually moved closer to reality. With practice-based teaching we arrive in the actual practice setting with real patients and real problems in real time. The instructor is a preceptor in a one-on-one learning situation in the working world of pharmacy practice. This is the ultimate learning environment for problem-solving skills. It is also the environment most filled with risk for patients and the most difficult for the preceptor to control, since the right case will not necessarily appear at the right time, nor is there any screen against unforeseen events. Rich in opportunity, it is the best we have to offer, but only if the preceptor exercises skill with appropriate teaching techniques and attends to building learners' confidence in their ability to give direct patient care to real people. Techniques suited to practice-based teaching are taught in Chapter 12.

Summary

Table 10-3 associates sound educational logic with the choices you make for instruction in your staff development program. You must match what you want pharmacists to learn with the method you use to teach. If you do not, you run the risk of laying unfair learning expectations on your pharmacist-learners. For example, what if you choose to teach your staff to design a medication therapy regimen by giving them a couple of lectures? A lecture only assures the possibility of knowledge-level learning. Where are they to acquire the other stage of learning—practical application (or application, analysis, and synthesis)—that is the prerequisite for this work?

Making sound decisions on appropriate methods requires that you engage in a certain type of thinking:

1. Formulate a clear picture of the type and level of learning specified in the educational objective you want your pharmacists to attain. That means identifying the taxonomy and the level of learn-

ing within the taxonomy. It also means understanding the objective's scope and the depth of its content.
2. Think long and hard about what will be going on in the pharmacists' minds as they successfully perform the objective.
3. Select methods that will best help the pharmacists think that way. Table 10-3 offers guidance, but you will still need to examine your situation and decide which of the choices available to you will work best. For example, practice-based teaching may be the ultimate method, but you may not have a preceptor to do it, or the skilled pharmacist preceptor may not be able to free the time for instruction.

Above all, keep in mind that learning is hierarchical. You cannot expect the pharmacist to learn to use an algorithm (application-level learning) to solve a patient care problem until the pharmacist has advanced through the knowledge and comprehension levels for that kind of problem. Consequently, learning needs to be staged, with readings and lectures on the topic followed by guided discussion and interactive lecture before the pharmacist works with a preceptor on a real case.

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Chapter 12
Developing Training Materials and Programs: Practice-Based Teaching

Christine M. Nimmo, Ph.D.

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Practice-based teaching, one-on-one teaching by a preceptor in the practice environment, is probably the most effective and time-honored method for transmitting the problem-solving skills of the profession to colleagues and to the next generation of pharmacists. As you learned in Chapter 10, practice-based teaching is most effective at the end of the instructional chain, when knowledge and comprehension have been acquired and the pharmacist-learners have had practice with cases in guided discussion, case-based teaching, simulations, and role play. In this chapter you will learn teaching techniques you can apply as you use the practice-based method. The 10 techniques derive from cognitive psychology's study of how people learn to solve problems, which was covered in depth in Chapter 10.

Techniques for Practice-Based Teaching: The View from Cognitive Theory

The 10 techniques for practice-based teaching in this chapter come from research in cognitive psychology concerning how we learn and how we solve problems. Your best route to skillful use of practice-based teaching is through understanding the relationship between learning and problem solving and the teaching techniques you use. This understanding will help you decide when to use what technique and will also help you diagnose what went wrong when you misjudge the situation.

Cognitive psychology's investigation of problem solving yields a framework of approaches to practice-based teaching that will help you help pharmacist-learners acquire skill in solving direct patient care problems:

- Use techniques to help pharmacist-learners organize content in their minds for quick, accurate recall.
- Use techniques to help pharmacist-learners accurately define and classify problems.
- Use techniques to help pharmacist-learners master problem-solving strategies.
- Use techniques to help pharmacist-learners monitor the quality of their own problem solving

Techniques for Practice-Based Teaching: The Preceptor's View

Few preceptors concentrate on cognitive problem-solving theory while they are working with pharmacists on developing problem-solving skills. The appropriate framework for directing teaching activity is Figure 10-5, the learning pyramid. As the pharmacist-learner's ability to solve problems grows, the role of the preceptor moves from direct instruction to modeling to coaching to facilitating. In direct instruction, the preceptor conveys information directly to the pharmacist-learner. When the preceptor judges that the pharmacist-learner now possesses the required foundation skills and knowledge, the preceptor switches to modeling. In this role the preceptor tries to serve as an example of excellence as he or she solves a direct patient care problem. The performance gives the pharmacist-learner a problem-solving strategy to imitate, a focus, a direction to pursue. Now the preceptor changes to the role of coach. While the pharmacist-learner executes a similar problem-solving task, the preceptor provides feedback that allows the pharmacist-learner to refine his or her level of skill. Part of the task of skillful coaching is successively assigning more difficult tasks. In the final role the preceptor becomes a facilitator who helps the learner grow in depth and breadth of practice skills by offering direct practice experiences.

Using the preceptor's role as a framework, Table 12-1 presents 10 techniques for practice-based teaching, identifying each with the appropriate cognitive approach.

You can now consider what the use of each of these techniques entails and how they tie in to the cognitive theory that spawned them.

Practice-Specific Content

The purpose of this technique is to add to the quantity of information about direct patient care in the pharmacist-learner's memory, because one of the characteristics of a person skilled in solving direct patient care problems is a wealth of pertinent information (the *what*). As preceptor, your task is to focus the selection of new content for the pharmacist-learner. Keep in mind that more than one exposure to the same content, but from varying viewpoints, may be desirable. Repeated experience with the same content strengthens understanding and increases the ability to recall information when it is needed. For example, suppose your pharmacy department services a nursing home. The pharmacist for whom you are the preceptor is about to practice on his or her first Alzheimer's patient. You might apply this technique by saying, "Tomorrow we will go over to the home and you will begin the management of Ms. Rogers' case. She's an Alzheimer's patient. You might want to look at the three articles in my Alzheimer's file that deal with the management of this disease. It would also be good to check out Harrison's for an overview."

Teach Relationships

The goal of using this strategy is twofold. First, by helping pharmacist-learners remember multiple pieces of related information as one unit, you are facilitating chunking, which allows more information to be used simultaneously in short-term memory to solve the problem. Second, you are helping pharmacist-learners integrate the branches of the trees (schemata) on which they store information. This helps them find related information quickly when it is needed. To use this technique you help the pharmacist-learner see relationships between different pieces of content. Sometimes that means telling; sometimes it means asking.

For example, consider a pharmacist who will manage his or her first pain patient. In preparation, you have focused the pharmacist-learner's reading on the psychology of pain, the management of anxiety, dependence, and addiction, and the psychosocial factors associated with terminal illness. You engage the pharmacist-learner in a series of discussions in which you encourage him or her to make connections between the multiple bodies of literature. For example, addiction may not be a problem when the patient is terminally ill or level of anxiety greatly influences the psychological response of the patient in pain. Questions you might use in that discussion include, "What is the association between the use of chemotherapy and the use of antiemetics?" and "How might the patient's nonadherence relate to what you know about his or her culture?"

Teach in the Problem-Solving Context

Your purpose in using this technique is to enable

Table 12-1. Practice-Based Teaching Techniques Associated with Preceptor Roles and Theories of Cognitive Problem Solving

PRECEPTOR ROLE	TECHNIQUE	ASSOCIATED COGNITIVE APPROACH
Direct Instruction	Practice-specific content.	Organize content in the mind for quick recall.
	Teach in context.	Organize content in the mind for quick recall.
	New content and direct patient care.	Organize content in the mind for quick recall.
Modeling	Teach strategies to help clarify problems.	Define and classify problems.
	Categories of direct patient care.	Define and classify problems.
	Explain your thinking as you solve a problem.	Master problem-solving strategies.
Coaching	Practice problems solving feedback.	Master problem-solving strategies
	Build confidence and efficency.	Master problem-solving strategies.
	Ask learners to explain their thinking.	Self-monitor quality of problem solving.
Facilitating	Self-evaluation.	Self-monitor quality of problem solving.

pharmacists to recall content that is related to solving a particular kind of problem whenever they encounter that type of problem in the future. Because pharmacists encounter most direct patient care practice problems as a function of a patient's medical problems, they will frame the problem they must solve as a medication therapy problem associated with a specific patient medical problem. As they begin the solving process, the first place they will look in their minds will be in the area where they stored the information on that particular medication therapy problem, as it is associated with that particular disease state. If they learn content while trying to solve a particular kind of problem, pharmacist-learners will store that content in the same place as the pattern for recognizing that kind of medication therapy problem and the strategies useful for solving it. One-stop shopping means pharmacists will be faster and more accurate in the information they pull into short-term memory as they try to solve the problem. This is in contrast to the traditional approach of teaching basic science without relating it to practice problems and to the practice of organizing study around drugs. Pharmacists practicing in health systems do not deal with medications, they deal with patients who have medication-related health problems. Therefore, the appropriate problem-related context is medication-related health problems.

An example of this technique is to wait until the pharmacist-learner is working on an acute leukemia case before suggesting that he or she read journal articles discussing a new medication for treatment of this disease.

Teach Strategies to Help Clarify Problems

Your purpose in using this technique is to help pharmacist-learners accurately represent the problem to solve in their minds so that they will recall all the relevant information needed for a solution. The information the pharmacist-learner accesses will depend completely on the formulation of the problem. If the problem representation is not an accurate picture of the problem, the wrong problem will be solved. If the problem is not represented clearly and unequivocally, the amount of information recalled will be as broad as the problem statement is vague. This will slow the problem-solving process.

There are specific strategies you can teach to help pharmacist-learners clarify problems.[1]

1. Ask clarifying questions of yourself or others.
2. When data gathered on the patient shows a recurring pattern, explore the redundancy of information to determine its significance.
3. Identify ambiguities.

Teach Patterns of Problems

Your aim is to help pharmacist-learners identify and recognize patterns that characterize different classes of problems so that when confronted with a problem, they can move speedily to the right category of problem-solving strategies. Use of this technique helps learners to see problems as a particular type, similar to others in that class, instead of viewing each problem as completely new. The recognition of patterns facilitates more accurate and efficient problem identification and helps the problem solver recall and use information specific to a particular type of patient case.[1]

You must help the pharmacist-learner focus on the similarities and differences between different types of problems. For example, suppose your pharmacist-learner is working with three asthma patients. Your task is to help the pharmacist-learner identify similarities and differences in the patients' medical problems and in their therapies. In summary, one goal of experiential training is to make more problems appear well structured to the pharmacist-learner (solvable by an algorithm, as discussed in Chapter 10) because of growth in the pharmacist-learner's ability to recognize patterns.

Explain Your Thinking as You Solve a Problem

This technique is at the core of modeling. It offers learners the opportunity to see (or hear) the problem-solving process they should use. Procedural knowledge (the *how*) grows only when the pharmacist-learner is consciously aware of the thinking processes the preceptor employs while solving a problem. Therefore, you must identify the algorithms and heuristics (rules of thumb that are used when algorithms don't work) you are using and talk out loud about the process. Because learning to use an algorithm or a heuristic does not necessarily enable an individual to understand why it works or when to use it, instruction must also include the *whys* and the *whens*.[2]

Talking aloud about your cognitive processes may be difficult for two reasons. You may have little conscious knowledge of your own thinking process. Saying what you are thinking may require you to stop and think a lot about what is going on before you can identify the processes accurately. Second, remember that by definition, expertise involves the automaticity of skills. When explaining how you solve a problem, you may not even know that you completely ignored intermediate steps. Often your pharmacist-learners will point this out to you because they could not follow your leap in thought. You may respond with, "Oh, I just followed my gut," or "I guess it's intuition," or

"That's just my clinical judgment based on years of practice." When you are tempted to reply this way, stop and try to remember when you were a novice. What steps did you go through at that time?

Provide Practice and Feedback

Practice with feedback helps pharmacist-learners improve their performance in using problem-solving strategies. Without feedback to signal the need for change and focus it in some direction, the problem solver's performance will remain static—no progress. Of course, in the practice environment, preceptors aren't the only sources of feedback. Physicians, patients, nurses, and others make contributions as well, but as the pharmacy preceptor, you have the heaviest responsibility for feedback, at least initially, because of your command of pharmacy problem solving. We say "initially" because eventually pharmacist-learners should become their own major source of feedback.

Ende[3] is the dominant figure in designing feedback processes in clinical education. He cites a critical problem called "vanishing feedback"—a problem you must overcome if you are to be effective as a practice-based preceptor:

> Anxious about the impact of the information on the trainee, but committed nonetheless to the need for feedback, the well-intentioned teacher talks around the problem or uses such indirect statements as to obfuscate the message entirely. The student, fearing a negative evaluation, supports and reinforces the teacher's avoidance. The result is that despite the best of intentions, nothing of any real value gets transmitted or received. Even worse, concerns about the impact of feedback may lead to no feedback at all.

But what constitutes feedback that will help learners improve their problem-solving performance? And what kinds of feedback will enhance learners' ability to become their own source of feedback in the future? The following are modifications of Ende's guidelines to suit the pharmacy staff development situation for offering feedback:

1. Prepare pharmacist-learners to receive feedback. Tell them in advance that you'll be talking with them about their performance. Talk with them about the things you will be looking for. If you've prepared an assessment instrument that lists criteria for a skill, give it to them before they try out the skill.
2. Convince pharmacist-learners that you are their ally. Let them know that the feedback, positive or negative, is not a punitive action but is to help them shape their own behavior and to help them become better problem solvers.
3. Base your feedback on firsthand data. Let's say you are the staff development coordinator, but the preceptor is the clinical coordinator. Don't have the clinical coordinator report to you on how the pharmacist-learners are doing and then, in turn, feed back the information to them. Instead, have the clinical coordinator do it.
4. Deliver feedback when it is well timed and, if possible, when expected. Watch out here for the human factor. If the pharmacist has had a disaster of a day, it might be smart to wait until morning to give negative feedback. You can set up patterns for when feedback is provided, or you can schedule formal feedback sessions to prevent making the delivery of feedback an unpleasant surprise. If pharmacist-learners know feedback is coming, they can gear themselves to be productive and positive in the session.
5. Your feedback should focus on specific performances. The statement that "your SOAP notes are a problem" doesn't give the pharmacist-learner anything to focus on for change other than a vague generality. On the other hand, saying "the subjective entry for Mrs. Hammonds doesn't include enough about the interview information you collected from her yesterday" is specific and focused and gives the pharmacist-learner something to grow on.
6. Phrase your feedback in a descriptive, nonjudgmental manner. The example in #5 illustrates this point. For the most part, judging is out, facts are in.
7. Regulate the quantity of feedback you provide at any one time. Remember that a pharmacist-learner can take in only so much or initiate only a certain number of changes at one time.
8. If you're going to offer your opinion rather than objective data in feedback, say so. Let pharmacist-learners know that this is your view and not necessarily the world's. They should have enough respect for your opinion that they will give it the world's weight anyway.
9. Encourage the pharmacist-learners to be part of the feedback process. Get them started by withholding your views and asking, "What do you think about how it went?" In so doing you encourage them to build their self-monitoring skills, and you may avoid having to say some hard things because they will say them first.

Build Confidence and Efficiency

It doesn't do much good for pharmacist-learners to be able to solve problems if they can't do it in the speeded-up environment of practice. Repeatedly solving the same type of problem builds the confidence and efficiency in problem solving that equates to speed. In fact, Anderson[4] states, "It requires at least 100 hours of learning and practice to acquire any significant cognitive skill to a reasonable degree of proficiency." In a study by Duong and Havel[5] it took practice on anywhere from 10 to 40 cardiac anesthesia cases to get the skill right. Granted, in the staff development situation, time to practice solving the same type of problem may be unavailable. Realistically, the practice that builds efficiency may have to wait until the learners go into the practice environment and are on their own.

Ask Learners to Explain Their Thinking

Using this technique helps pharmacist-learners grow in their ability to redirect their problem-solving efforts as the problem solving is occurring. In turn, this leads to mastery of problem-solving strategies. It will probably be almost as hard for you to get learners to talk about their thought processes as it is to get yourself to do it. Learners usually have not automatized their thought processes or had much experience talking about them.

Self-Evaluation

When you use this technique, you help pharmacist-learners develop self-direction. This is the key to professional growth and the development of skill in direct patient care problem solving. You may have to teach pharmacist-learners how to do self-evaluation before giving them opportunities to practice it. The ability to self-evaluate is an acquired skill. Fuhrmann and Weissburg[6] give six steps in self-evaluation:

1. Establish criteria.
2. Collect data.
3. Compare the data with the criteria.
4. Make a judgment.
5. Make a decision.
6. Take appropriate action.

Pharmacist-learners will have the greatest difficulty with the first step, establishing criteria. Thus the most effective way to promote self-evaluation is to provide pharmacist-learners with specific criteria against which to judge their performance. An excellent source of these criteria is the set included in the Pharmacy Practice Competency Checklist introduced in Chapter 6.

Summary

If you are an experienced preceptor, you may have read through this description of techniques nodding your head and saying to yourself, "Yes, I do that." If so, you have likely acquired these skills and the sense of when to use them from good modeling by your preceptors and probably your own intuitive sense of what constitutes good practice-based teaching. The challenge to you, the experienced preceptor, is to go back through the list and determine those techniques in which you are not as strong as you would like to be. The hardest to do well is to explain out loud what you are thinking as you solve a problem. For a dedicated preceptor, this could involve a lifetime pursuit of increasing skill in identifying your thought process and making it clear to others. In fact, it is this capacity to unpack your thinking and explain it to others that ultimately makes you not only an expert practitioner of direct patient care but an expert preceptor for direct patient care as well. The final message, whether you're a pro or a beginner, is focus on this skill first.

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