

# 2

## From Curricular Goals to Instruction: Choosing Methods of Instruction

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Curricula by definition are planned educational events, and there is a generally agreed-upon process for this planning (1). Every accreditation body in medical education requires that written curricula include *learning objectives*, *educational methods*, and *evaluation* plans (2–4). To assist in the development of these components, this chapter briefly discusses the following steps in the planning process: conducting a needs assessment, articulating overall goals, developing specific learning objectives, measuring results and, finally, evaluating the curriculum itself. The emphasis of this chapter is on fitting specified methods of teaching, described in subsequent chapters of this book, with curricular goals and objectives. This chapter does not include a complete discussion of evaluation designs; this is covered in greater detail in another book in the *Teaching Medicine* series, *Leadership Careers in Medical Education* (5); readers can consult other references for a more technical discussion of that topic (6).

### ❖ Needs Assessment

Goals and objectives for a major educational intervention ideally follow a *needs assessment* that identifies and characterizes the health care problem that will be addressed, how it is currently being addressed, and how it should be addressed. At a minimum, the needs



**KEY POINTS**

- A well-constructed curriculum includes specific and measurable objectives, appropriate methods of instruction to achieve those objectives, and a plan for evaluation of learners and the program.
- Competency-based learner objectives in medical education include knowledge, attitudes, skills, and behavior objectives.
- Methods of instruction should be congruent with curricular objectives and methods of evaluation.
- Choosing the appropriate method of instruction will require knowledge of the learners and of the content and the context in which the learning takes place. This often involves the additional step of performing a needs assessment.
- Many educational theories describe how adults learn; attention to the principles of adult learning theory will improve the efficiency and effectiveness of learning.
- Methods of instruction, as well as evaluation methods, can affect learning environments in both positive and negative ways.

assessment puts the topic into epidemiologic perspective and informs the course director of current versus ideal clinical practice and teaching strategies related to the health care problem. Such information can usually be obtained by reviewing the published literature and selected Internet sites (7) (for example, sites of professional organizations), and by collecting relevant information about one's targeted learners and medical institution (1). For more limited educational activities, such as a single lecture in a pathophysiology course, the needs assessment may focus on the prerequisite learning needed to master the new content to be presented (see also chapter 3 of this book). Examples of the types of needs assessment information that are useful in choosing the goals, objectives, content, and learning methods for one's curriculum include the following:

- For the health care problem: How does it affect patients, health care professionals, medical educators, and society? How does it affect clinical outcomes, quality of life, work and productivity, use and cost of health care and other resources, and societal function? What are the most effective management strategies? How do these compare to current practice?

- For learners and their medical institution: What is the developmental stage of the learners (early clinical students, evolving clinical students, experienced practitioners)? Is there a mix of learners (for example, students, residents, other health professional students)? What are their previous and already planned training in this content area? Is there an opportunity to build on or complement other training? What is known about learners' existing proficiencies and deficiencies, about their preferred learning styles and methods? What is known about the informal or hidden curriculum at their institution (8)? Who are the other stakeholders in the curriculum (for example, course directors, clerkship directors, residency program directors, accrediting bodies), and what are their needs?
- For educators: What are the most effective educational approaches? How do these compare to current approaches? Who will be teaching the curriculum to the targeted learners? Are the teachers content experts? Are they skilled in desired teaching methods? Will faculty development be needed? Are there previously validated evaluation instruments that can be used to evaluate the curriculum?
- Context: What is an appropriate context for learners in which to learn this content? Can more than one context be used to deepen the learning?

Needs assessment methods range from systematic reviews of the medical education literature (9) and formal surveys (10) to informal interviews with groups of learners, faculty, or other stakeholders. The needs assessment provides a foundation for the curriculum that grounds it in best evidence of effectiveness and relevance to the learners. It informs each of the subsequent steps of educational planning: writing goals and objectives, choosing appropriate instructional methods, and planning learner and program evaluation. The needs assessment "makes the argument" for the curriculum, and prepares for needed resources to implement it. A scholarly needs assessment places the curriculum in the context of the educational literature, defines its generalizability, and forms the background for its wider dissemination.

### ❖ Goals

Goals are generally written in broad terms that are easy to communicate to all the stakeholders, including program directors, funding agencies, teachers, and learners. Goals provide desired overall direction for a curriculum.



For example, one goal of a medicine clerkship rotation for medical students may be: *To learn the initial evaluation and management for the most common diagnoses seen on the general internal medicine inpatient service.*

A goal for an intern orientation week program may be: *To teach incoming interns the appropriate patient safety and quality procedures as detailed in the Hospital Interdisciplinary Clinical Practice Manual.*

The following goal could be used for a continuing medical education program: *To provide practicing internists current information and discussion on new developments in cardiovascular medicine.*

## ❖ Objectives

Determination of methods for instruction should follow from the goals and objectives. If goals are broad and general, objectives are specific and measurable. Objectives can be at the level of the individual learner or the program.

### Learner Objectives

Learner objectives focus the curriculum content and inform learners of what is to be achieved. They usually flow from the needs assessment as described in the preceding section. Assuming that the goal of the educational program is to achieve competence in some area of health care, defining that competence usually includes a description of the requisite *knowledge, attitudes, and skills* that the learner will need to acquire. Learner objectives then are categorized into three types: cognitive (knowledge), affective (attitudes), and psychomotor (skills or behaviors), often described as the “KAS” framework. These types of objectives are important to note, as you will see later, in choosing the methods of instruction.

Within each type of objective, there is a hierarchy of complexity and achievement. This is most famously described for the cognitive objectives with Bloom’s *Taxonomy of Educational Objectives* (11). Bloom’s taxonomy lists six levels of cognitive objectives, which not only describe a level of knowledge obtained but also imply the steps of learning required to reach that level. This taxonomy has been revised many times; one of the most recent versions uses the following descriptors of mental tasks: to remember, understand, apply, analyze, evaluate, and create (12). For medical education objectives, for instance, *remembering* factual knowledge (anatomic names for the heart) would be a low-level cognitive objective, whereas *analyzing* an electrocardiogram tracing and the underlying pathophysiology of rhythm disorders would be a higher-level objective. Course directors would want to write the highest expected level of achievement for the learner, oth-

erwise known as the terminal objective. For each event in the course, the objective may describe an enabling objective for this terminal objective. In the example above, a learning objective for the “Cardiovascular Block” course for medical students may be that students will be able to interpret electrocardiogram tracings. A lecture objective within this course may be that learners will be able to explain the normal electrophysiology of the heart.

To ensure that objectives are specific and measurable, it helps to have a template structure for writing the objective. One behavioral method (1) is to structure the objective statement so that it answers the question, “Who will do how much/how well of what by when?” The verbs (“will do”) in the objectives describe the behaviors expected of the successful learner, and the nouns (“what”) describe the content of the educational program.

Let’s say that a workshop is being developed to teach internal medicine interns the proper insertion of central venous catheters. The learner objectives for this workshop could be: *By the end of the 4-hour workshop,*

- *Each intern will be able to cite the risks and complications associated with insertion of central venous catheters.* (Knowledge)
- *Each intern will correctly demonstrate correct procedural steps for insertion of the central venous catheter (as outlined in the observation checklist).* (Skill)
- *Each intern will be committed to minimizing risk for infection during invasive procedures.* (Attitude).

Some considerations in writing learning (or learner) objectives are the following:

- Keep the number of objectives manageable. Too many objectives overwhelm learners and instructors and may diminish the impact of the objectives. This may require combining several similar objectives into one. In the knowledge objective above, “risks and complications” is somewhat general, but it is presumed that several specific risks and complications will be reviewed in the workshop, and that interns will be able to discuss these with patients before the procedure.
- When choosing the verbs for the objectives, use as specific a verb as possible, and one that will imply how the objective will be measured. Verbs such as “will know,” “will understand,” and “will appreciate” don’t necessarily indicate how the objectives will be measured. Table 2-1 shows more useful verbs to use in writing specific measurable objectives.



**Table 2-1. Verbs or Phrases for Use in Writing Objectives**

Type of Objective	Specific Verbs or Phrases
Cognitive	list, write, recite
	identify
	define
	interpret
	explain
	illustrate
	generate a differential diagnosis, differentiate
	generate a hypothesis
	discriminate
	compare and contrast
	construct
	analyze
	solve
Affective	rate as valuable
	rate as important
	rank as enjoyable
	recognize as having an impact
Psychomotor	demonstrate
	show
	use (in practice)

- Not every curriculum will have all types of objectives. An online curriculum in preventive medicine, for example, could have several knowledge objectives but would be unlikely to have psychomotor objectives.

### Program Objectives

What are program objectives and why do we need them? Writing program objectives provides planners with an opportunity to prospectively define the success of the curriculum. Program objectives could simply be written as aggregated learner objectives; for example: "All residents will achieve  $\geq 80\%$  on a knowledge examination at the end of the course." To sustain the curriculum, those developing the curriculum need to know whether the curriculum was implemented as planned. Objectives that address implementation issues are described as *process objectives* for the curriculum. Examples of process objectives include:

- Attendance: *All residents will attend the workshop for its entirety.*
- Participation: *All residents will participate in a role play and debrief with their peers.*
- Functionality: *No resident will report difficulty in logging on to the curriculum Web site.*
- Quality: *Each lecture will be accompanied by detailed lecture notes.*

Many course directors have more ambitious program objectives in mind. These are often termed *outcome* objectives. Some may be conveniently measured, for example:

- Satisfaction: *All residents will report that the role play was a useful method for learning behavioral change counseling.*
- Self-assessed competence: *Residents participating in the workshop will report improved self-efficacy in motivational interviewing techniques.*
- Reported behavior change: *Three months after the workshop, participants, as compared with nonparticipants, will be more likely to report use of the "5As" approach to behavior counseling in their encounters with patients who smoke.*

Other program objectives, such as changes in objectively measured skills, behaviors, or health care outcomes, are more difficult to measure, such as this one:

- Changes in documented resident behaviors and health outcomes: *One year after the course, an audit of patient panels of participant residents will show an increase in documentation of the smoking status of patients and a decline in tobacco use compared with patient panels of nonparticipant residents (13).*

Although sometimes possible to obtain, as in the preceding example, such outcome measurement is frequently not feasible. Nevertheless, the inclusion of some behavioral or health care outcome objectives emphasizes the ultimate aims of a curriculum and should influence the choice of curricular content and educational methods.

### ❖ Methods of Instruction

Table 2-2 lists the most common methods used in teaching medicine, and subsequent chapters in this book describe several of these methods in more depth. This table highlights the type of objective (and domain) for which each method is best suited, and, for each method, its advantages, its limitations, and the resources required. As noted earlier, the objectives identified through the needs assessment should inform the course director about the most effective method to achieve the goals of the course, but there are



**Table 2-2. Common Instructional Methods Used in Teaching Medicine\*****Instructional Method: Readings**

## Objective or Domain

- Knowledge
- Affective

## Advantages

- Easily available
- Provides the necessary groundwork in new content for novice learners
- Well-organized and evidence-based
- Can be accessed at optimal time for learners

## Limitations

- Passive
- Teacher-centered, since teacher has chosen the material
- If not regulated, may overload learners
- May not be used by learners
- Learning may be superficial, with students relying on short-term memory
- Unlikely to affect long-term knowledge or affect unless paired with another application activity

## Faculty and Learner Resources Needed

- Minimal faculty resources
- Online access possible with learning management software or through institutional library electronic reserves
- Need to watch copyright issues, especially in distance-based learning
- Programmed learning requires development

## Examples

- Textbooks
- Journals
- Literature (for affective objectives)

## Modifications That Enhance Active Learning and Learner-Centeredness

- Programmed learning: learners are intermittently queried about what was just presented and receive feedback (eg, ACP's MKSAP)

**Instructional Method: Lecture**

## Objective or Domain

- Knowledge
- Affective

**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)**

## Advantages

- Provides the groundwork in new content for novice learners
- Presentation software widely available
- Well-organized and evidence-based
- Can be videotaped and reviewed at a later time or online

## Limitations

- Passive
- Teacher-centered
- Danger of too much information (i.e., "cognitive overload")
- Limited by attention span of learners
- Learning can be superficial unless paired with another application activity

## Faculty and Learner Resources Needed

- Presentation skill development

## Examples

- Medicine grand rounds
- House staff noon conference
- Medical student lecture, "Approach to Diabetes Mellitus"

## Modifications That Enhance Active Learning and Learner-Centeredness

- Insert activity every 10–15 minutes (e.g., question, discussion with neighbor) (30)

**Instructional Method: Discussion Groups**

## Objective or Domain

- Knowledge and higher cognitive objectives
- Affective

## Advantages

- Participatory
- Develops social skills

## Limitations

- Learners often need preparatory understanding of content (e.g., reading or prior learning)
- Need time and facilitation to ensure all learners are engaged
- Learners may be frustrated if not skillfully facilitated



**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)****Faculty and Learner Resources Needed**

- Preparation of materials and facilitation of learners
- Skills of facilitation, such that discussion meets the objectives
- More class time required of learners
- More facilitators required; increased faculty:learner ratio
- If using case-based discussions, may need development of cases and instructors' guides to ensure equivalent experiences across groups

**Examples**

- Problem sets in a pharmacology course (33)
- Problem-based learning about nutrition in a clinical curriculum (31)
- Journal clubs

**Modifications That Enhance Active Learning and Learner-Centeredness**

- Problem-based learning (32)
- Team-based learning (34)

**Instructional Method: Case Discussion****Objective or Domain**

- Knowledge
- Affective
- Skill
- Higher-order objectives of critical thinking, interpreting, and analysis

**Advantages**

- Embeds learning in the real context of a patient
- Objectives can be adjusted "on the fly" by the faculty discussant
- Learner-centered if learners are allowed to set objectives (i.e., query the expert)
- Including patient perspective facilitates attitudinal and professionalism objectives

**Limitations**

- Not always available; if relying on available cases for learning, may limit breadth of learning
- Good for auditory learners; may be a problem for other learning preferences
- Team members may have disparate experience and knowledge

**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)****Faculty and Learner Resources Needed**

- Instructor must possess medical expertise to teach
- Instructor facilitation and bedside teaching skills; should not "take over" the case
- Learner time: If coupled with work rounds, for instance, can impair the workflow for the team
- Paper or virtual cases require development

**Examples**

- Attending teaching rounds in a medicine clerkship (35)
- Attending rounds on a consultation service (e.g., CDIM SIMPLE online cases)

**Modifications That Enhance Active Learning and Learner-Centeredness**

- Use "microskills" of clinical teaching (36)
- Set objectives of the discussion by querying learners
- Summarize the discussion when closing it, and negotiate "next steps" in learning

**Instructional Method: Demonstration (Modeling)****Objective or Domain**

- Skill

**Advantages**

- Modeling a skill can incorporate other "hidden" objectives, such as patient-centeredness, professionalism (37)

**Limitations**

- Passive
- Teacher-centered
- Requires that teaching material be available

**Faculty and Learner Resources Needed**

- Teacher must possess the skill to be demonstrated

**Examples**

- Bedside cardiovascular examination
- Bedside medical interview
- Teaching knee arthrocentesis



**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)**

Modifications That Enhance Active Learning and Learner-Centeredness
<ul style="list-style-type: none"> <li>• Set up the demonstration by clarifying with learners what should be observed</li> <li>• Summarize the demonstration by asking learners to reflect on what was observed</li> </ul>
<b>Instructional Method: Role Play</b>
Objective or Domain
<ul style="list-style-type: none"> <li>• Affective</li> <li>• Skill</li> </ul>
Advantages
<ul style="list-style-type: none"> <li>• Active</li> <li>• Participatory</li> <li>• Cost-effective, uses learners as the “simulators”</li> <li>• Learners can appreciate different perspectives when portraying roles</li> </ul>
Limitations
<ul style="list-style-type: none"> <li>• Learners may be resistant (e.g., “I hate acting” or “This doesn’t feel real”)</li> <li>• Takes time to set up the role play and debrief effectively</li> </ul>
Faculty and Learner Resources Needed
<ul style="list-style-type: none"> <li>• Faculty facilitation skills</li> <li>• “Safe” environment that allows learners to take risks and reflect honestly on the experience</li> </ul>
Examples
<ul style="list-style-type: none"> <li>• Smoking cessation curriculum, two residents role-play a physician using motivational interviewing techniques (13)</li> </ul>
Modifications That Enhance Active Learning and Learner-Centeredness
<ul style="list-style-type: none"> <li>• Learner can be invited to set an objective for the role play (e.g., a particular skill he or she would like to try)</li> <li>• Can be video-recorded for review</li> <li>• Use “Time Out” technique to get feedback from group members</li> <li>• Summarize learning points and ask for commitments to change behaviors</li> </ul>

**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)**

<b>Instructional Method: Standardized Patient</b>
Objective or Domain
<ul style="list-style-type: none"> <li>• Skill</li> <li>• Affective</li> </ul>
Advantages
<ul style="list-style-type: none"> <li>• Active; participatory</li> <li>• Standardized patients can be trained to give feedback</li> </ul>
Limitations
<ul style="list-style-type: none"> <li>• Teacher-centered in that the objectives and environment have been created by the teacher</li> <li>• Learners may be resistant (e.g., “I hate acting” or “This doesn’t feel real”)</li> <li>• Standardized patient cases must be developed with checklists, and standardized patients must be trained</li> <li>• Can be costly; requires standardized patient training time as well as portrayal time</li> </ul>
Faculty and Learner Resources Needed
<ul style="list-style-type: none"> <li>• Trained standardized patients</li> <li>• Development of standardized patient cases, with validated checklists (38)</li> </ul>
Examples
<ul style="list-style-type: none"> <li>• Medical students learn clinical reasoning with the medical interview (39)</li> <li>• Practitioners practice motivational interviewing techniques in a smoking cessation workshop (40)</li> </ul>
Modifications That Enhance Active Learning and Learner-Centeredness
<ul style="list-style-type: none"> <li>• Can be videotaped for review by learner or with faculty facilitator</li> <li>• Incorporating self-assessment can facilitate skill development of self-assessment</li> </ul>
<b>Instructional Method: Simulators</b>
Objective or Domain
<ul style="list-style-type: none"> <li>• Knowledge</li> <li>• Skill</li> </ul>



**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)****Advantages**

- Active
- Participatory
- Contextual
- “Safe” learning environment; removes anxiety of causing patient harm when learning a skill
- Skill can be practiced with feedback

**Limitations**

- Not always available
- Can result in negative learning if not carefully developed

**Faculty and Learner Resources Needed**

- High-tech simulators can be expensive
- Faculty may need training to use effectively
- Instructor:student ratio usually high
- Development of simulator exercises with valid checklists needed

**Examples**

- “Harvey” cardiac simulator
- “Sim-Man” anesthesia simulator
- Partial task simulators (e.g., vascular access) (41)

**Modifications That Enhance Active Learning and Learner-Centeredness**

- Using small groups of learners at a time, can incorporate team and communication skills as well as psychomotor skills (42)

**Instructional Method: Writing****Objective or Domain**

- Knowledge
- Affective
- Higher-order skills of synthesis and analysis, creativity

**Advantages**

- Active
- Participatory
- Can facilitate habits of reflection
- Embeds and deepens learning

**Limitations**

- Learners may resist writing and reflection
- If embedded in contact teaching hours, requires time
- Requires skillful introduction

**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)****Faculty and Learner Resources Needed**

- Time required to do the writing
- Optimal if there is opportunity for learners to receive feedback or discuss

**Examples**

- Learning portfolios (43)
- Journaling during a substance abuse rotation
- Medical students write about a positive experience with elders in a geriatrics course (44)

**Modifications That Enhance Active Learning and Learner-Centeredness**

- Follow writing with small-group discussion

**Instructional Method: Learning Projects****Objective or Domain**

- Knowledge
- Affective
- Skill
- Higher-order skills of analysis, synthesis, and creativity

**Advantages**

- Active
- Participatory
- Learners can set goals and objectives
- Addresses higher-order skills of analysis and synthesis

**Limitations**

- Learner resources needed

**Faculty and Learner Resources Needed**

- Learners need skill in accessing necessary resources
- Time and effort required on part of the learner
- If mentoring is used, high faculty:learner ratio required

**Examples**

- Residents on the block ambulatory rotation meet as a group to design a practice quality improvement project
- Student groups design and implement a community-based health education project (45)

**Modifications That Enhance Active Learning and Learner-Centeredness**

- Incorporate self-assessment and reflection
- Incorporate peer evaluation



**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)****Instructional Method: Self-Assessment**

## Objective or Domain

- Attitude
- Skill
- Higher-order skills of analysis

## Advantages

- Promotes self-directed and lifelong learning habits

## Limitations

- Most effective with mentoring; if not mentored, may be inaccurate and reinforce negative learning

## Faculty and Learner Resources Needed

- Faculty mentoring may increase faculty:student ratio
- Both learners and faculty need to be clear about objectives

## Examples

- Learning plans developed at the start of a rotation
- Face-to-face feedback that begins with learner self-assessment of progress toward goals
- Learning portfolios (46, 47)

## Modifications That Enhance Active Learning and Learner-Centeredness

- Allow objectives for the self-assessment to be set by the learner

**Instructional Method: Experiential**

## Objective or Domain

- Knowledge
- Attitude
- Skill

## Advantages

- Contextual; deepens other learning experiences
- Effective in addressing hidden curriculum issues

## Limitations

- Not always available
- May not be equivalent for all learners
- Without appropriate debrief, can reinforce negative learning

**Table 2-2. Common Instructional Methods Used in Teaching Medicine\* (continued)**

## Faculty and Learner Resources Needed

- High faculty:learner ratio
- Instructors should be aware of modeling opportunities
- Faculty facilitation and debriefing skills
- Learners should be prepared with objectives, some prior knowledge, and observation skills

## Examples

- Ambulatory preceptorship for medical students (36)
- Hospice experience in an end-of-life rotation
- Home visit in an internal medicine geriatric rotation (48)

## Modifications That Enhance Active Learning and Learner-Centeredness

- Allow goals of the experience to be set by the learner
- Bridge new information to prior knowledge
- Ensure a cogent summarization of the experience with a plan for future learning
- Embed some time for reflection

ACP = American College of Physicians; CDIM = Clerkship Directors in Internal Medicine; MKSAP = Medical Knowledge Self-Assessment Program.

\*Numbers in parentheses are reference citations.

several other considerations in choosing an instructional method, including the following list.

1. Instructional methods should be consistent with principles of learning.
2. Instructional methods should be congruent with learner objectives.
3. Multiple instructional methods are better than a single instructional method.
4. Instructional methods can affect the learning environment and have unintended consequences.
5. The choice of methods is often driven by resource limitations.

**1. Instructional Methods Should Be Consistent With Principles of Learning**

As course directors contemplate potential educational strategies, they should consider principles and issues related to learning, and related to learning by adults in particular. *Teaching* is what educators do, but *learning* is what happens within the learner. The job of teachers, therefore, is largely to *facilitate*



learning in curriculum participants. Deeply understood by the ancients, and promulgated by 20th-century educators, is the *andragogic* approach to learning, which is based on the following principles: that adults learn best when they are motivated to learn and set their own goals, when the learning is built on previous experience, and when there are frequent reflection and feedback on how well they are learning (14–16). Learning that promotes the questioning of one's thought processes, behaviors, assumptions, beliefs, and values, along with the consideration of multiple points of view, can result in what has been termed *transformative* learning, which occurs when learners change in meaningful ways (14, 15, 17, 18). Embedding these principles of adult learning into specific instructional methods can improve the efficiency and effectiveness of learning. For instance, a lecture that begins with an application of the concept (for example, case scenarios of disorders of thyroid function) and then presents the concepts (for example, thyroid function), rather than the reverse, is using the principle of motivating learners, by informing them *why* they need to know the concept before presenting the concept. As an example of transformational learning, a video clip showing an interaction with a challenging patient could be used as a trigger tape in a curriculum on managing substance abuse. By promoting reflection and group discussion of learners' assumptions, beliefs, and values, and their potential impact on care, the exercise could promote self-awareness and management of biases in the care of such patients.

A common approach to using andragogic learning principles is the popular "Socratic method" of questioning, often used in hospital teaching rounds (see chapter 1 in *Teaching in the Hospital*, another book in the *Teaching Medicine* series [19]). In this method, the teacher starts with the case (why does the learner need to learn this), asks a question to determine the learner's previous knowledge or experience, helps the learner to deepen that knowledge with further questioning, and may provide immediate feedback. (Socratic questioning uses simple questions to connect what learners already know, or may know but not appreciate at the moment, and what they need to know to solve a problem. When the instructor ignores the previous knowledge or experience, and asks questions beyond the student's current knowledge base, this is not Socratic questioning. This has been called "pimping," or "tell me what I am thinking," an anxiety-provoking and unproven method of learning [20, 21]). An example of effective Socratic-type questioning follows:

*Example: On the general medical service, Dr. Smith is rounding with Mia and Joe, third-year medical students. Joe has presented his admission from the night before, a patient with cirrhosis and altered mental status.*

*Dr. Smith: Mia, this patient is suffering from liver failure. How do we judge the severity of his disease?* [Before telling his students how to assess liver function, he is assessing how much they know about assessing liver function]

*Mia: I'm not sure.* [This student hasn't learned this yet; no point in asking her what the Model for End-Stage Liver Disease (MELD) score is.]

*Dr. Smith: Think about the important liver functions. What does the liver do?* [Teacher is assessing the limit of her previous knowledge about liver function and failure.]

*Mia: It excretes bilirubin in the bile.* [Student is remembering basic physiology knowledge; this is the starting point for talking about assessment of liver failure.]

*Dr. Smith: Right, so bilirubin levels tell us one indicator of liver function. What else does the liver do?*

*Mia: It synthesizes coagulation factors.*

*Dr. Smith: Right, so how can we measure how impaired this function is?*

*Mia: The INR?* [Without additional information transfer, the student has reasoned what one of the important indicators of liver function should be.]

*Dr. Smith: Correct. So we can measure serum bilirubin and INR. Joe, what other measures do we have clinically to assess the severity of this patient's liver disease?* [Teacher is assuming Joe has done recent reading on this topic because he admitted the patient.]

*Joe: The MELD score also includes serum creatinine, since renal dysfunction that happens as a result of ineffective circulation is also a poor prognostic indicator. This patient's MELD score was 23, indicating a 76% mortality in the next 3 months.* [Joe has obviously learned the scoring system on his own and is ready to teach others.]

*Mia to self: "I didn't know that; I'd better read up on the MELD score."* [Mia sets a new learning goal for herself.]

Another way to think of these principles is to decide how learner-centered versus teacher-centered and how active versus passive the method should be. *Teacher-centered* instructional methods allow the instructor to



set the learning goals and use an approach that is often the most comfortable for the instructor. The teacher controls the transfer of information. The teacher is usually active and the learner passive, although teacher-centered learning can also be interactive. The classic didactic lecture is an example of a teacher-centered method. Teacher-centered methods may be most appropriate for large numbers of learners or for learners with less previous knowledge or experience in the content area. Some argue that these educational methods do not result in effective learning and are simply “information sharing,” a superficial form of learning that results only in short-term memory learning. *Learner-centered* methods imply a flexibility that allows the learners to set learning goals and methods based on previous experience, previous learning, and preferences. This facilitates the process of moving knowledge from short-term memory into a mental model, called a cognitive schema, that allows retrieval of the information when needed (22).

The distinction between teacher- and learner-centered methods is not simplistic, however. Many faculty will introduce active learning strategies into a lecture, for example, that inform learners of how well they are learning or orients the discussion around why they should learn the content. Technology has allowed the adaptation of instructional methods to include more active and more learner-centered approaches. Videotaping lectures and posting them online, for instance, allows learners to access the lecture at a time that is most conducive for the learner to listen. In many instances, learners can pace the information that is given in the lecture, listening in double-time for parts that are easily understood, and stopping and repeating for parts of the lecture that need more time. Interactivity of the learner with a computer program, with intermittent self-assessment questions, informs the learners of how well they are learning. The use of audience response systems is another method of increasing learner-centeredness. The lecturer may insert questions periodically in the lecture and ask participants to respond; by looking at the responses from the group as a whole, it may be apparent to the lecturer that some material needs to be explained again or with another approach. Subsequent chapters in this book will explain how methods can be enhanced to address principles of adult learning and learner-centeredness.

Going beyond the principles of adult learning, transformational learning, and learner-centeredness, many educational theories attempt to describe how we learn, and therefore suggest optimal instructional methods. Major theories in use in medical education are the behavioral learning, the cognitive learning, the humanist, the social learning, and the constructivist theories (analogous to the experiential theory of learning described in chapter 1 of *Theory and Practice of Teaching Medicine* [23]) (24). Table 2-3 briefly defines these theories and provides example instructional methods that are supported by them (see also chapter 2 in *Theory and Practice of Teaching Medicine*).

**Table 2-3. Educational Theories Supporting Instructional Methods**

**Educational Theory: Behavioral Learning Theory**

Definition

- Learning is the acquisition of observable behaviors that occur through conditioning. Objectives are written as observable behaviors. The teacher controls the environment and provides feedback.

Type/Domain Objective

- Competency
- Behavior change in a practitioner

Medical Education Example

- Simulations: Practicing the correct procedures of running a code team, receiving feedback
- Direct observation of the medical interview: Practicing open-ended questions in a medical interview course; receiving feedback

**Educational Theory: Constructivist (Experiential) (49)**

Definition

- Learning is an active process by which the learner is constructing meaning from new sensory input (i.e., integrating experiences into previously held knowledge and beliefs). The teacher facilitates the mental task involved in constructing meaning, such as reflection on an experience.

Type/Domain Objective

- Knowledge
- Affective
- Skill/competency

Medical Education Example

- Activities that incorporate reflection, such as:
  - Listening to a physician–patient interview and reflecting on the patient’s perspective
  - Debriefing a code team’s performance
  - Examining a patient with a neurologic lesion and relating it to previously learned neuroanatomy

**Educational Theory: Social Learning Theory (50)**

Definition

- Learning occurs through observing behaviors of others and the outcomes of those behaviors. Methods include observation, imitation, and modeling. The steps in learning are attention, retention, reproduction, and motivation. The teacher is a role model.

*continued*



**Table 2-3. Educational Theories Supporting Instructional Methods (continued)**

Type/Domain Objective
• Competency
Medical Education Example
• One-on-one clinical teaching, such as an ambulatory preceptorship: A medical student observes a clinician screening for alcohol abuse, imitates it successfully, and incorporates it into future practice
<b>Educational Theory: Humanism (51)</b>
Definition
• Learning occurs as a mechanism of self-actualization and self-fulfillment. Affective and cognitive needs are addressed through learning; the teacher is a facilitator.
Type/Domain Objective
• Cognitive
• Affective
Medical Education Example
• Activities that encourage self-directed learning and self-assessment, such as learning projects and learning portfolios
• Discussion groups that allow learners to explore new ideas, set their own learning objectives, and find new information on their own, such as problem-based learning
<b>Educational Theory: Cognitivist (22)</b>
Definition
• Learning results from inferences and making connections with prior knowledge. Knowledge is seen as symbolic mental structures. Learning involves the active process of moving information from short-term memory into knowledge structures. Instruction should be structured and well-organized with feedback to the learners.
Type/Domain Objective
• Knowledge
• Higher-order cognitive objectives
Medical Education Example
• Information transfer followed by activities that encourage synthesis, analysis, and higher-order cognitive skills, such as:
• Renal failure lecture followed by team work to generate differential diagnoses for diagnostic dilemmas
• Creating maps, tables, or other memory aids to facilitate retrieval of knowledge

\*Numbers in parentheses are reference citations.

## 2. Instructional Methods Should Be Congruent With Learner Objectives

Learning is contextual—what is learned in one situation is not always transferred to a different context. A student may “learn” the pathophysiology of congestive heart failure by attending a lecture, but may not recognize that pathophysiology when seeing a patient in clinic. Effective teaching methods often present material in the same context in which the learner will need this learning. Attention to the verbs used in the learner objectives is again helpful here.

Let’s take the objectives written for the intern workshop on central venous catheterization. Because the intent of the workshop is to improve patient care, the best instructional methods will allow interns to practice the behaviors that would be used in patient care. The first objective, that interns *will be able to cite* the risks and complications of central venous catheterization, could be learned in a lecture, or by reading, but will be much more powerful if the intern is then required to “*cite* the risks” in a *role play* discussion of informed consent with a patient. Similarly, the correct procedural steps could be introduced through a video or demonstration, but the psychomotor skill is best learned by practice and feedback with a *simulator*, that is, allowing the learner to “*demonstrate* the correct procedure.” As a rule, some instructional methods are more useful in achieving certain types of objectives (Table 2-2).

## 3. Multiple Instructional Methods Are Better Than a Single Method

This principle addresses the reality that learners have a variety of learning preferences or learning styles (25). Having more than one method improves the likelihood that significant learning will occur. In addition, using more than one method allows reinforcement of the learning without the appearance of redundancy, and deepens learning by practicing in different contexts. For example, let’s say the goal of a short curriculum is that medical students will learn proper hospital infection-control procedures. The methods could include an online curriculum that introduces the appropriate protective equipment and procedures for infection control with a video. After watching the video, students practice gowning in small groups, and simulating sterile technique with a partial task simulator, such as lumbar puncture.

## 4. Instructional Methods Affect the Learning Environment and Can Have Unintended Consequences

Instructional methods can convey messages to learners that are more powerful than the content of the curriculum. To say that a curriculum is designed to develop critical thinkers and lifelong learners and then rely heavily on lecture methods that do not address these objectives may result



in learners who devalue those objectives. Using frequent individual assessments to drive learning can create competition and thwart the development of team and social skills. On the other hand, embedding reflection and self-assessment into instructional methods may facilitate habits of reflection and self-directed, autonomous learners. Providing opportunities to work in teams and to assess team skills encourages development of team skills as well as providing meaningful experiences for the learning. In general, following the principles above will result in an effective curriculum that conveys respect for the learners and fosters professional values.

### 5. The Choice of Methods Is Often Driven by Resource Limitations

Major resource issues include space (facilities use), technical costs (paper, software, computer stations), development costs, faculty time, and learner time, all of which may force the choice of one method over another. Students generally enjoy simulations and report good learning, but simulations may be expensive to develop and run, and the simulators are not always available. Discussions require more curricular time and faculty facilitators than lectures do. Some affective objectives, such as cultural competence, may be effectively addressed by faculty role modeling of appropriate behaviors, but that requires a critical mass of trained faculty modeling these behaviors. A significant learner resource is time. Table 2-2 provides information on resources required for different methods. The course director often must balance what is ideal (on the basis of one's needs assessment and application of the above principles) with what is feasible. Understanding the ideal, however, can stimulate the development of innovative, creative approaches that are feasible, such as the team-based learning method developed as a method of integrating small-group discussions into the context of large class sizes (26).

### ❖ Evaluation

Evaluation is an important step in the educational process that benefits from thoughtful planning. This chapter focuses on the uses of evaluation and the choice of evaluation methods. It does not specifically discuss evaluation design, the reliability and validity of measurement instruments, data analysis, evaluation reports, or ethical concerns. Rigorous evaluations can become quite sophisticated. If they become foci for dissemination or publication, they are considered educational research and require consultation with one's institutional review board. As mentioned earlier, a more detailed discussion of evaluation, both programmatic and learner-specific, can be found in *Leadership Careers in Medical Education* (5), as well as other references (6).

An important consideration in planning for an evaluation is to clarify how the evaluation will be used. Is it critical to demonstrate learner competence, as in such certification courses as advanced cardiac life support? Do learners have a need to know whether they have achieved the objectives? Or is the major concern for the course director to know that the program objective was achieved, as in continuing medical education courses? Can the evaluation be embedded in another evaluation plan (for example, one lecture's evaluation may occur in the end of course examination)? Are there an interest in disseminating the curriculum or justifying its resources and a need to document its effectiveness? Evaluation plans range from simple to elaborate; understanding how the evaluation will be used allows the planners to prioritize evaluation methods. Table 2-4 provides a general framework for an evaluation plan.

Just as *objectives* are written at the learner level and at the program level, *evaluations* are usually planned at the learner and the program levels (additional discussion of this topic is provided in *Leadership Careers in Medical Education* [5]). Curricula with the most impact inform learners how they are doing during the course (*formative evaluation* with feedback) as well as whether they have achieved objectives at the end of the course (*summative evaluation* with feedback). It is helpful to remember that formative evaluation methods that are administered to learners during a curriculum also serve as methods of instruction.

Considerations listed above for deciding on instructional methods also apply to decisions regarding the choice of evaluation methods. *Evaluation methods should be consistent with the principles of adult learning*. In keeping with these principles, feedback from effective evaluations is specific and constructive and provides learners with information that allows

**Table 2-4. Levels and Generic Uses of Evaluation**

Generic Use	Level	
	Individual Learner	Program
Formative	Is the learner making progress in achieving the objectives? How can the learner improve performance?	Are all learners making progress in achieving the objectives? How can the program be improved?
Summative	Did the learner achieve the objectives? How well?	Did all learners achieve the objectives? Did the program achieve its process and outcome objectives?



in learners who devalue those objectives. Using frequent individual assessments to drive learning can create competition and thwart the development of team and social skills. On the other hand, embedding reflection and self-assessment into instructional methods may facilitate habits of reflection and self-directed, autonomous learners. Providing opportunities to work in teams and to assess team skills encourages development of team skills as well as providing meaningful experiences for the learning. In general, following the principles above will result in an effective curriculum that conveys respect for the learners and fosters professional values.

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them to set the next personal learning goal. Using a standardized patient assessment that just provides students with a checklist score does not help them understand how to improve their performance. On the other hand, modern online software for knowledge testing can allow learners not only to see a final score immediately but also review the items answered incorrectly, and plan for further study. Once again, it is important to maintain congruence with the objectives and instructional methods. If objectives are specific and measurable, the learner evaluations will flow easily. For example, if the goal of the educational event is acquisition of a skill, it would be inappropriate to assess learning with a written examination; rather, an appropriate measurement would be to assess the acquisition of the skill by observing learners' performance with simulators, standardized or real patients. Table 2-5 provides information on various evaluation methods and their uses, advantages, and limitations.

Because no measurement is perfect, the most valid assessments use the strategy of "multiple measures by multiple observers at multiple points of time." This may be feasible for major competencies, such as communication or clinical reasoning, or in long curricula, such as a residency training program, where there may be multiple opportunities for learner assessment.

**Table 2-5. Common Evaluation Methods, Uses, Advantages, and Limitations**

<b>Method: Global Rating Forms</b>	
Uses	<ul style="list-style-type: none"> <li>• Knowledge, attitude, skill</li> <li>• Objectives</li> <li>• Formative and summative</li> </ul>
Advantages	<ul style="list-style-type: none"> <li>• Easy to distribute and complete</li> <li>• Frequently used online</li> </ul>
Limitations	<ul style="list-style-type: none"> <li>• Subjective</li> <li>• Rater biases (halo effect)</li> <li>• Limited inter-rater reliability because scales are interpreted differently</li> <li>• Contextual information is lacking</li> </ul>
<b>Method: Multisource Feedback</b>	
Uses	<ul style="list-style-type: none"> <li>• Knowledge, attitude, skill</li> <li>• Objectives</li> <li>• Formative and summative</li> </ul>

*continued*

**Table 2-5. Common Evaluation Methods, Uses, Advantages, and Limitations (continued)**

<b>Advantages</b>	
	<ul style="list-style-type: none"> <li>• Rich context from multiple observers increases validity</li> <li>• Open text can generate good qualitative information</li> </ul>
<b>Limitations</b>	
	<ul style="list-style-type: none"> <li>• Resource intensive to develop appropriate instruments, distribute, collect, analyze, and communicate results</li> <li>• Not all respondents (such as patients) can be trained as evaluators</li> </ul>
<b>Method: Self-Assessment Forms</b>	
Uses	<ul style="list-style-type: none"> <li>• Knowledge, attitude, skill</li> <li>• Objectives</li> <li>• Formative and summative</li> </ul>
Advantages	<ul style="list-style-type: none"> <li>• Easy to distribute and complete</li> </ul>
Limitations	<ul style="list-style-type: none"> <li>• Subjective</li> <li>• Rater biases</li> <li>• Correlation with objective measures has been historically low</li> <li>• Considered the least rigorous form of learner assessment</li> </ul>
<b>Method: Questionnaires</b>	
Uses	<ul style="list-style-type: none"> <li>• Attitude, skill, and performance</li> <li>• Objectives</li> <li>• Formative and summative</li> </ul>
Advantages	<ul style="list-style-type: none"> <li>• Easy to distribute and complete</li> <li>• Can generate quantitative data</li> </ul>
Limitations	<ul style="list-style-type: none"> <li>• Subjective</li> <li>• Responses can be influenced by social desirability</li> <li>• Requires moderate resources to develop validated tools</li> </ul>
<b>Method: Focus Groups</b>	
Uses	<ul style="list-style-type: none"> <li>• Knowledge, attitudes, skill</li> <li>• Formative and summative</li> <li>• Program evaluation</li> </ul>

*continued*



**Table 2-5. Common Evaluation Methods, Uses, Advantages, and Limitations (continued)****Advantages**

- Qualitative
- Can generate pertinent items for questionnaires
- Can develop "theory" to be further tested

**Limitations**

- Requires expertise in resources to facilitate the focus group and analyze the results
- Results may depend on participation, which could be biased

**Method: Written Tests (multiple-choice exams)****Uses**

- Knowledge, objectives
- Formative and summative

**Advantages**

- Can achieve good psychometric properties, with internal reliability
- Software can assist in mapping to complex curricula
- Generates quantitative data that help in making decisions about performance

**Limitations**

- Reliable tests require resources for development and psychometric testing
- Resources required for administration and scoring and communication to learners

**Method: Written Essay****Uses**

- Knowledge, affective, and skill objectives
- Formative and summative

**Advantages**

- Provides opportunities to demonstrate higher cognitive objectives, such as reasoning
- Provides opportunities to demonstrate habits of reflection
- Provides a rich context for setting future learning goals

**Limitations**

- Rater biases in scoring
- Requires qualitative methods and resources to analyze

**Method: Oral Examinations****Uses**

- Knowledge, especially higher cognitive objectives, such as clinical reasoning
- When scored, usually summative

*continued***Table 2-5. Common Evaluation Methods, Uses, Advantages, and Limitations (continued)****Advantages**

- Face validity

**Limitations**

- Rater biases
- Subjective scoring

**Method: Direct Observation****Uses**

- Skill and behavior objectives
- Formative and summative

**Advantages**

- If using checklists, trained observers can provide reliable and objective results

**Limitations**

- Requires development of checklists, opportunities for observation (simulated or real), and trained observers (faculty)
- Can be resource intensive

**Method: Logs****Uses**

- Skill and behavior objectives

**Advantages**

- Objective
- Documents real-life experience
- Can be tool for reflection

**Limitations**

- Only as valid as learner entries
- Electronic entry can help with analysis, but otherwise resource intensive to analyze

**Method: Performance Audits****Uses**

- Skill and behavior objectives

**Advantages**

- High face validity
- Can generate quantitative data
- Can be a tool for reflection and self-directed learning

**Limitations**

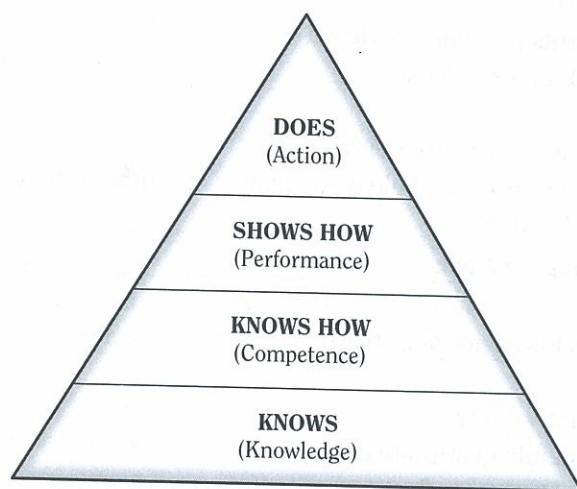
- Depends on available data sources and what is reliably recorded; misses what is not documented



The multiplicity of data points increases the reliability and validity of the assessment. For such programs or in high-stakes situations, planners should consult additional resources on evaluation design and psychometrics. Reliability and validity are less critical for shorter educational events, such as a bedside teaching encounter, lecture, or workshop.

One model of learner assessment in medical student education has been Miller's pyramid (27) (Figure 2-1). As learners advance in expertise, they pass through the following stages: "knows," "knows how," "shows how," and, finally, "does." The model allows an ultimate objective to be the incorporation of certain behaviors into clinical practice. Ideally, the evaluation should aim to assess the highest point of the pyramid that is appropriate for the level of learner and objectives of the educational program. Medical education curricula are faulted for not designing assessments that address the "shows how" (assessment of skill) and "does" (behavior in clinical practice) levels of skill because it is assumed that competence at these levels is more likely to affect patient outcomes (28). Usually, however, the higher the point on the pyramid, the more resource-intensive the evaluation.

Resource limitations are also a consideration in designing evaluations. Course planners may not have the resources of standardized patients or high-tech simulations. If the goal of the evaluation is to support educational research, the evaluation plan will aim for the highest level in a hierarchy of designs from pretest/post-test comparisons to randomized, controlled



**Figure 2-1** Framework for clinical assessment. Reproduced with permission from Miller GE. The assessment of clinical skills/competence/performance. *Acad Med.* 1990;65:S63-S67.

trials. Ethical issues, such as just allocation of curricular time and resources and confidentiality, should also be considered.

There is perhaps no element of an educational event that affects the learning environment more than the evaluation plan. The educational truism "Assessment drives learning" makes the point that what is evaluated is what learners will strive to achieve. For example, an evaluation that tests knowledge objectives but ignores interpersonal skill development objectives communicates that knowledge is more valued than interpersonal skills. Evaluations that include peer assessments appear to foster professionalism (29). How much time is devoted to evaluation rather than learning, what kind of learning is evaluated (factual knowledge vs. critical thinking skills), scoring systems (satisfactory/unsatisfactory vs. number grades), communication and confidentiality of results, will all affect the learning environment.

### ❖ Summary

Internists teach in a variety of situations, from the lecture hall with large audiences to precepting in the clinic with a single trainee. Whether planning for a complex curriculum or preparing for hospital rounds, the quality of an educational experience can be enhanced by the processes outlined in this chapter: assessing needs, articulating goals and objectives, considering the optimal methods to achieve those objectives, assessing achievement of the objectives, and reviewing the evaluation results available to the teacher. But the process of moving from curricular goals to methods of instruction is not a line, with a beginning and an end; rather, it is a loop, in which evaluation informs further curricular and instructional decisions and so on. The most creative teaching often involves rethinking goals and methods. Refining the specific methods of instruction will be discussed in subsequent chapters.

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