

# Teaching Functional Life Skills to Children with Developmental Disabilities

## *Acquisition, Generalization, and Maintenance*

Ronnie Detrich  
Thomas S. Higbee

A developmental disability is a disability that typically is present at birth, such as Down syndrome, but that may also become apparent later (e.g., autism). Developmental disabilities, which can involve cognitive and/or physical impairments, are chronic and present throughout the child's life. A defining characteristic of these students is the failure to acquire functional life skills in the same manner as typically developing children. In most instances these skills must be directly taught. For the purposes of this chapter, we discuss teaching methods for those students with cognitive impairments.

Functional life skills are defined as those skills that are important in the typical contexts in which a student interacts—such as home, school, work, and recreation—and that are likely to be valued and supported by the members of these communities. Examples of these skills include dressing independently, preparing meals for oneself and others, using public transportation to get to work, and maintaining friendships. The goal is for the student to perform these skills as independently as a typically developing student of the same age can (Reid et al., 1985). If the student is not independent, the strategy is to provide the support necessary for the student to be successful. Until the goal

of independence is accomplished, teaching should continue. Life skills are usually divided into domains that reflect the emphasis on skills that are important in different contexts. The domains usually include self-care (dressing), domestic (meal preparation), vocational (working), recreation/leisure, community (using public transportation), functional academics (using a calculator to determine price of items), communication (making wants and needs known to others), and social and self-management (setting an alarm to wake up in time for school or work).

The idea of independence is an important concept in educating students with disabilities. The more a student functions independently, the more competent he or she is perceived to be. For every task that a student with disabilities can perform independently, someone else does not have to assist or perform the task. As a consequence the student may be perceived as (and is) making meaningful contributions to the community by taking care of him- or herself. There are several approaches to assessing and determining which skills to teach that are beyond the scope of this chapter (see Chapter 3 in Snell & Brown, 2000, for a thorough review of assessment). Effective teaching is funda-

mental to creating independent students. It is necessary to have effective instructional methods so that students learn new skills in the most efficient manner possible.

### Teaching

The purpose of this chapter is to describe effective teaching methods that offer the best opportunity for students to become independent. Before we describe specific teaching procedures, a brief discussion of general concepts that guide all instructional practices is warranted. There are three separate phases of effective teaching: (1) acquisition, (2) maintenance, and (3) generalization of the skill being taught. Acquisition describes the process of directly teaching the student until a skill is mastered. This phase receives the most attention in the discussion of instructional methods.

The two remaining phases of effective teaching, maintenance and generalization, are just as important as acquisition. When beginning instruction for a new skill, acquisition is the primary focus; however, maintenance and generalization should be planned for at the same time. Attending to these dimensions of instruction in the beginning will make them more likely to be achieved. Maintenance is the process of ensuring that once a skill is learned the performance remains durable over time, even though direct instruction may have decreased or been terminated.

Generalization occurs when a skill is performed in circumstances that are different from those of the original teaching situation such as with different persons, settings, or behaviors. It is important to develop effective methods to promote generalization, because it is unlikely that instruction during the acquisition phase will encompass all of the settings and environments in which the skill is relevant. Consider the following example. In the course of teaching a student to do laundry, it is necessary that he or she learn to operate a coin-operated washing machine. There are at least two different dimensions that are likely to require generalization across washing machine types (front loading vs. top loading and coins flat vs. coins on edge) if the student is to be able to successfully do laundry. It cannot be as-

sumed that a student will be able to operate a front-loading or coins-flat machine if she or he has been taught on only a top-loading, coins-on-edge machine. It will be necessary to actively promote generalization if the student is to successfully wash clothes regardless of the type of machine.

In the research literature, methods for promoting generalization have received greater attention than maintenance-enhancing strategies. This discrepancy does not reflect the relative importance of the two phases of learning. If behavior generalizes but does not maintain, then the acquisition and generalization of the skill have resulted in no lasting benefit for the student. Although a thorough review of generalization and maintenance strategies is beyond the scope of this chapter, Stokes and Osnes (1988) have provided a nice framework for considering the topic (see also Daly, Barnett, Kupzyk, Hofstadter, & Barkley, Chapter 29, this volume). They outline three principles of generalization: (1) take advantage of natural communities of reinforcement, (2) train diversely, (3) incorporate functional mediators. The principle of taking advantage of natural communities of reinforcement is based on the idea that the environmental contexts in which students live and work will naturally support adaptive behavior once it is established. For example, when a young child learns to speak, the natural community of reinforcement of family, teachers, and friends will respond to most efforts to communicate. When using this principle, special programming for generalization is not required. It is likely that many other functional life skills will maintain and generalize once they have been acquired because others in the student's life will reinforce these behaviors.

The second principle of generalization, training diversely, is based on the notion that teaching across a wide variety of contexts with a large group of teachers and using multiple stimuli is more likely to result in generalization than teaching in which the training situations are narrowly defined, in which instruction is limited to one person, and in which a small array of materials are used as instructional tools. The latter may result in more rapid acquisition but result in limited generalization. Consider the example of teaching a student to shop for items in a grocery store. If the shopping is restricted

to one store and a small list of items, one would expect the student to learn where the items are relatively quickly; but if he or she is required to shop at a different store or for different items, he or she may well perform no better than before training. On the other hand, if shopping occurs across a wide variety of stores and across a wider variety of items, initial acquisition of shopping skills may be delayed, but, once mastered, the student will be much more likely to be effective in novel settings.

The final principle of promoting generalization, incorporating functional mediators, relies on the concept of stimulus control in which stimuli associated with training in one setting are likely to occasion relevant behavior in a second setting if they are present. An example would be tying a string around your finger to remind you to do something. The idea is that the string functions as functional mediator and will occasion the behavior in the relevant situation. The same logic applies to promoting generalization for students with developmental disabilities. When students are provided with functional mediators, it is possible for them to perform much more effectively across a variety of situations. In a job setting, it would be possible to arrange a picture task analysis to prompt the student through a job sequence. Similarly, when the student is on break, he or she can be given a list of conversation starters on a series of index cards so that he or she will be more likely to initiate an appropriate conversation to engage coworkers. Each time one of the conversation starters is used, it can be moved from one pocket to another so that the student does not become repetitious. Topics can be expanded and updated over time.

### ***The Learning Trial***

There are three components to effective instruction, which are referred to as the *learning trial*: (1) instruction, (2) response, and (3) feedback. The instruction sets the occasion for the student to make some type of response for which feedback will be given. The instructor is responsible for the first and last of these three elements, and how they are approached, in large part, determines the quality of the learning for the student.

The function of the instruction is to specify to the student that a response of a particular type is to occur (e.g., saying, touching, doing). Effective instruction increases the probability of correct responding by the student. Instructions can include both verbal direction from the teacher, such as “brush your teeth,” and gestural and physical prompts that guide the student through tooth brushing. Visual presentation of instructional materials such as a toothbrush can also be part of the instruction. In the early phase of acquisition, it is likely that the instruction will involve multiple forms of presentation. As the student’s learning increases, the instructor will reduce the components of the instruction until the least prompt necessary to occasion the desired response is in place, such as a picture schedule indicating what comes next. The ultimate goal of instruction is for the student to respond only to naturally occurring cues in the environment and for the teacher’s presence to be irrelevant.

The instruction does not have to be identical in form but, rather, should be of the same functional class. A functional class is a set of behaviors that all result in the same consequence. For example, if the goal is to teach a student to respond to greetings, it would be appropriate for the instruction to vary across forms of greetings, such as “hello,” “hi,” “good morning,” and so forth. Because all of these forms of greeting are likely to result in the same response from others, they are considered to be in the same functional class. Early in the training it is likely that the spoken greeting would be paired with a wave of the hand as well. In addition, the student might be verbally instructed as well as physically guided to wave. Over time, the types of instructions and the level of instructions are faded until the only instructions would be a wave on one occasion, a verbal greeting on another, and a combination of the wave and verbal greeting on a third. This approach in the acquisition phase may facilitate generalization as well. Stokes and Baer (1977) describe this method of training loosely as a generalization-promoting strategy.

The response component of the learning trial requires careful consideration before initiating teaching of a skill. The first consideration is what constitutes an acceptable response so that positive feedback can be provided. There is a delicate balance be-

tween narrowing the acceptable form of the response so that any variation is unacceptable and having such a broad definition that almost all forms are acceptable. In the example of teaching the greeting response just discussed, there are many acceptable ways to respond to a greeting, including waving, speaking, activating a touch talker (an assistive technology device which provides programmed speech output when a symbol is touched), or nodding one's head. When determining the response in the learning trial, it is important to consider what forms of the behavior are likely to be reinforced by the student's family, friends, and coworkers. If response forms are selected that are not reinforced by individuals in the student's social environment, the behavior will not maintain or generalize.

The student's abilities are a second consideration in determining the response form. For example, when trying to teach a student with poor fine motor skills to independently dress him- or herself, one should select shoes with Velcro rather than with laces. Requiring a student to perform a task that he or she is physically incapable of or for which he or she has not been taught the prerequisite skills is likely to result in behavior and learning difficulties. The student is likely to engage in problem behavior to escape or avoid the instructional activity or to become emotionally distressed over poor performance. In either instance, student learning will suffer.

The final component of the learning trial is feedback. The primary function of feedback is to increase the probability of correct responses occurring and decrease the probability of errors on subsequent learning trials. Feedback for correct responses is positive reinforcement. It is most effective when delivered immediately following the correct response. Error correction procedures generally involve nonreinforcement for incorrect responses and some type of additional prompting for the correct response. Reinforcement and error correction procedures are described in greater detail in subsequent sections of this chapter.

### ***Opportunities to Respond***

Once the three components of the learning trial are well developed, then the teacher must turn attention to the number of oppor-

tunities to respond during an instructional period. High rates of opportunities to respond increase the learning rate for students, because there are more opportunities for reinforcement for correct responses and for the shaping of incorrect responses to correct ones. Conversely, low rates of opportunities to respond result in slower learning because feedback occurs at a lower rate. Responding without feedback does little to increase learning. Once a skill has been mastered, practice without feedback may contribute to maintenance of the skill.

### ***Component and Composite Skills***

Many of the functional skills that are important to teach are composed of sequences of other, more discrete skills. The broad sequence of skills is referred to as a *composite* skill, and the individual, discrete skills are *component* skills (Johnson & Layng, 1992). If a student is to learn how to make a peanut butter sandwich (composite skill), it will be necessary for the student to learn the component skills of twisting the lid off the jar of peanut butter, opening the bread bag, and spreading the peanut butter with a knife. Until each of these component skills is mastered, the student will not be able to independently make a peanut butter sandwich. These skills can all be taught in the context of making a sandwich, or they can be taught separately and then combined to teach the composite skill of making a peanut butter sandwich. There is no clear agreement within the field about which is the preferable instructional method. Instructional methods are described in greater detail in the sections that follow.

### ***The Teaching Environment***

The teaching environment can be conceptualized as a continuum, with community settings as one end point and analogue settings as the other end point and with a series of intermediate environments such as classrooms between the two end points (Cuvo & Davis, 2000). An analogue setting is one such as a classroom in which the teaching materials are approximations of what may be found in a community setting but are not the same. For example, a teacher might arrange a mock intersection in the classroom to teach

students the fundamental skills of crossing a street before taking them out to streets in the community. Proponents of analogue settings make the case that there is more control over the instructional environment and that distraction from irrelevant stimuli is minimized, making instruction during the acquisition phase more efficient. It is also argued that more instructional trials are possible in analogue settings so that learning occurs more rapidly. The proponents of community-based training argue that the instruction is more naturalistic and has the advantage of requiring less planning for generalization as the skills are being taught in the relevant setting.

Several studies have examined the effects of community-based training relative to training in analogue settings, and no clear advantage to either community-based or analogue settings has been found (Cuvo & Klatt, 1992; Neef, Iwata, & Page, 1978; Neef, Lensbower, Hockersmith, DePalma, & Gray, 1990; Page, Iwata, & Neef, 1976). It should be noted that the lack of differences between the two training settings was obtained when the training was being conducted and supervised by very skilled researchers. It is not clear whether these same results would have been achieved if implemented in typical settings by the usual staff in these settings. One could make the argument that because there were no differences between training in the two settings, then training should occur in natural settings to minimize issues of programming for generalization. A counterargument is that training in analogue settings may be less expensive and more efficient as more training trials can be completed in an instructional day and less time is spent in transportation to the natural setting where the instruction can occur. Although the efficiency argument is compelling, it is recommended that training occur as much as possible in community-based settings to minimize some of the problems of promoting generalization.

A second reason to teach in community-based settings is that analogue settings do not contain many of the distracting events that are found in the community setting. It is better to teach with the distracting stimuli present from the beginning rather than introducing the distractions later in the training and having them disrupt performance.

Finally, teaching in the community setting is more desirable because students with disabilities are allowed access to the same activities, events, and experiences as peers without disabilities. There are many subtleties of a community-based setting that cannot be replicated in analogue training settings. There may be instances in which it is not feasible to teach in community settings, but the community should be the first option when developing a teaching program.

### Basic Principles of Reinforcement

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In the discussion of the learning trial, the third component is described as feedback. The feedback given to students for correct responding is positive reinforcement. Reinforcement is the behavioral process by which behavior is strengthened, or made more likely to occur in the future. Positive reinforcement is the behavioral procedure in which the probability that a behavior will occur is increased by virtue of adding or delivering something following that behavior. The positive reinforcer, the "something" added, can be either external to the behavior (e.g., providing a student with access to a preferred activity following correct completion of a self-care task) or the natural environmental product of the behavior itself (getting to go out of an open door following the behavior of turning the door handle and opening the door). Positive reinforcement is a critical component of behavioral teaching procedures.

In addition to being highly effective at producing behavior change, positive reinforcement has a number of desirable side effects. First, students tend to enjoy participating in teaching programs that employ positive reinforcement because their behavior is consistently acknowledged. They may also gain access to preferred objects, activities, or situations (positive reinforcers). A second benefit is that students tend to enjoy working with instructors who deliver positive reinforcement because the instructors come to take on the same value as the reinforcers they deliver. A third benefit of using positive reinforcement is the positive effect that adding reinforcement can have on the overall learning environment. In many cases, if enough positive reinforcement is delivered to

students, a decrease in some problem behavior will occur. For instance, if students are receiving a high rate of positive reinforcement in the classroom (e.g., teacher praise and attention), this can reduce problem behaviors exhibited to gain attention.

It is important to remember that reinforcement is defined by its effects. A particular item or activity is a reinforcer only if it effectively increases the future probability of the behavior that it follows. Based on this functional definition of reinforcement, it follows that what is "reinforcing" to one person may not be reinforcing to another. Also, what is "reinforcing" to someone at one point in time might not be at another point. There are no "universal" reinforcers that will always work with all students. For example, although praise and acknowledgment from a teacher or parent might be a powerful reinforcer for many students, it might be completely irrelevant or even punishing to some. Thus it is important to identify a variety of reinforcers for individual students in order for positive-reinforcement-based teaching programs to be successful.

### ***Using Positive Reinforcement Effectively (Dimensions)***

The manner in which reinforcement is delivered can influence the effectiveness of positive reinforcement as a teaching procedure. How immediately the reinforcer is delivered following the targeted behavior, the magnitude of reinforcement delivered, and the schedule of reinforcer delivery can determine the success or failure of a positive-reinforcement-based intervention. With regards to immediacy, the general rule of thumb is that positive reinforcement is most effective when it is delivered immediately (within a few seconds) after the targeted behavior. As students are constantly "behaving," if reinforcement is delayed, the teacher may end up inadvertently reinforcing the wrong behavior. Consider a situation in which a teacher is working with a student to teach him or her to follow one-step directions. The teacher gives the instruction "raise your hand," with which the student complies by raising his or her hand. As the teacher turns around to get the preferred item that she or he was planning on delivering, the student begins to wave his or her hand in front of his or her

face in self-stimulatory fashion. The teacher then delivers the item along with verbal praise. Even though the teacher intended to reinforce hand raising, it is more likely that she or he reinforced the student's behavior of waving his or her hand in front of his or her face. Thus it is important that tangible reinforcers be readily available so that they can be delivered immediately (within a few seconds) following the desired behavior.

The magnitude, or amount and quality, of reinforcers delivered can also influence the effectiveness of a positive-reinforcement-based teaching procedure. Generally speaking, higher quality and greater amounts of reinforcement will be more effective than lower quality and smaller amounts of reinforcement when teaching new behaviors. Once behaviors have been acquired, the magnitude of reinforcement can often be reduced as part of a behavioral maintenance program. Another guideline to follow is that the magnitude of reinforcement delivered should roughly correspond to the difficulty of the task the student is asked to perform. The more difficult the task, the higher the magnitude of reinforcement that should be delivered when the student correctly completes the task. For example, if sitting down at a desk when given an instruction to do so is an easy task, then periodic delivery of a brief praise or acknowledgement statement such as "thanks for sitting" might be a sufficient reinforcer. In contrast, if a student completes a 10-step hand-washing task for the first time without adult assistance (a difficult task for this student), then a higher quality reinforcer, such as access to a preferred magazine for a few minutes, should be delivered. For more information about how response effort, schedule of reinforcement, and delay in reinforcement can influence responding, see Horner and Day (1991).

Reinforcers can be delivered following every correct student response (a continuous schedule of reinforcement) or following some correct responses (an intermittent schedule). Continuous reinforcement is most effective when teaching new skills, whereas intermittent reinforcement promotes maintenance of skills once they are acquired. Thus, when teaching new behavior to students, the most effective approach would be to start with a continuous schedule and then gradually change to an intermittent schedule once

the behavior has been acquired so that the behavior is more likely to be maintained (see Hagopian, Contrucci-Kuhn, Long, & Rush, 2005, for an example of how to fade from a continuous to an intermittent schedule).

### **Reinforcer Identification Procedures**

Behavioral instructional programs provide learners with developmental disabilities with opportunities to practice and acquire important skills. The success or failure of these programs often depends on the quality of reinforcement that is provided for appropriate learner behavior. Identifying effective reinforcers can be the most challenging and important part of the intervention program. Over the past several years, a behavioral technology, called *stimulus preference assessment (SPA)*, has been developed that allows practitioners to identify potentially effective reinforcers for learners with autism and other disabilities. Modern SPA techniques involve systematically providing learners with opportunities to choose between potentially reinforcing items or activities and then measuring their choices. Although there are multiple strategies for conducting preference assessments that may be effective, only the most time-efficient method, the *multiple stimulus without replacement (MSWO)* method, is discussed here.

The MSWO method was first developed by DeLeon and Iwata (1996) and then later streamlined by Carr, Nicholson, and Higbee (2000). In an MSWO assessment, multiple (usually 5–8) items or activities are presented simultaneously in a row (often called a stimulus array) in front of the learner. An instruction to make a selection such as, “Choose the one you want the most,” is given, and the student is then allowed to choose between the items or activities by touching or picking up one of them. After making a selection, the individual is allowed to consume or interact with the item or activity for a brief period of time. The selected item is not replaced in the stimulus array, and the remaining items are resequenced by taking the item from the far right of the array, moving it to the far left of the array, and then centering the items in front of the student. The individual is then allowed to make another selection. This process continues until all items have been selected or no

item is selected within a brief period of time (usually 5–10 seconds). Usually, this entire process is repeated three (Carr et al., 2000) to five (DeLeon & Iwata, 1996) times, although comparable results may be obtained in some cases by completing the selection process only once (Carr et al., 2000). A selection percentage is calculated for each item or activity by dividing the number of times an item or activity is selected by the number of times an item or activity was available for selection and multiplying by 100. Items are then ranked according to the selection percentage. It is important to note that selection percentages in the MSWO procedure are used only for ranking stimuli and do not indicate relative preference for each of the items. Researchers suggest that items ranked first in MSWO preference assessments are most likely to function as reinforcers (e.g., Carr et al., 2000; Higbee, Carr, & Harrison, 2000). Data obtained by Daly et al. (in press) and Higbee et al. (2000) also suggest, however, that items ranked second and third may function as reinforcers in many cases.

Carr et al. (2000) attempted to reduce the amount of time required to complete the MSWO assessment by reducing the number of stimulus arrays from five to three. They conducted these “brief” MSWO procedures with three learners with autism and then examined the reinforcing effectiveness of items or activities identified as being high, medium, and low preference by the brief MSWO by delivering these items or activities contingent on learner academic behavior. They found that the brief MSWO procedure accurately predicted reinforcer effectiveness, as contingent delivery of high-, medium-, and low-preference stimuli produced responding that corresponded to the degree of preference. In a secondary analysis, Carr et al. (2000) calculated correlation coefficients for the stimulus rankings produced by learner selections in the first stimulus array with the rankings produced by the combined results of the three arrays and found that the correlations were high, indicating that conducting an MSWO preference assessment with one stimulus array may be sufficient to accurately rank items and activities. The authors reported that the brief MSWO assessments could be completed in 10 minutes or less when three stimulus arrays were used. The time could be further decreased if only one

Student: \_\_\_\_\_ Assessed by: \_\_\_\_\_  
 Date: \_\_\_\_\_ Time: \_\_\_\_\_

Stimulus Items	Rank by Trial			Sum of 1, 2, and 3	Overall Rank (smallest sum is #1)
	1	2	3		

FIGURE 22.1. Brief MSWO Preference Assessment data sheet.

stimulus array was used. The brief MSWO assessment data sheet (Figure 22.1) can be used to record and analyze the data from the assessment. For specific guidelines and suggestions for using the brief MSWO procedure, see Higbee (2009).

### *Issues in Preference Assessments*

Preferences have been shown to be relatively stable for some students and to fluctuate greatly for others (Carr et al., 2000). As such, a conservative approach would be to conduct preference assessments at least daily. It would be preferable to complete a preference assessment multiple times per day, such as before each teaching session or when the student's performance starts to deteriorate, if possible. To determine which items to include in the preference assessment, a good strategy is to watch what the student interacts with during "free play." Informal interviews with parents or other caregivers can also provide information about what to include in the assessment. It is important to include new items so that the student is exposed to them during the stimulus sampling procedure. It is also important to keep trying new items in a search for new potential reinforcers.

Researchers suggest that combining edibles and nonedibles in the same preference assessments may be problematic in some cases, as some students tend to select edible

items before nonedible items even though the nonedible items may actually function as reinforcers (DeLeon, Iwata, & Roscoe, 1997). Thus, if a student appears to be selecting all of the edible items before the nonedible items, consider whether it may be best to conduct separate preference assessments for edibles and nonedibles.

The use of pictures or symbols instead of actual items or activities has also been investigated (e.g., presenting pairs or arrays of pictures of potential reinforcers and asking learners to choose which one they would most like to earn for working). Presenting potential reinforcers in a verbal forced-choice format (e.g., "Would you like to work for candy or music?") has also been evaluated. Results of research on the use of verbal or picture/symbol-based preference assessments have been mixed, with some studies showing positive effects (e.g., Graff & Gibson, 2003) and others not (e.g., Higbee, Carr, & Harrison, 1999). A critical variable appears to be whether or not access to the chosen item or activity is provided following a selection response. Preference assessments appear to be more accurate when access to the chosen item is provided following a selection response (Tessing, Napolitano, McAdam, DiCesare, & Axelrod, 2006). A second critical variable when considering the use of pictures or symbols in preference assessments is the participant's history of using pictures or symbols to gain access to items. This history



appears to be necessary in order for symbols or pictures to be effective in preference assessments. In summary, when possible, it is best to use the actual items or activities in preference assessments. Pictures and symbols or verbal preference assessments should be used with caution until further research determines the conditions under which they can most effectively be used.

### General Teaching Methods

The methods of instruction described in this section can be used alone or with other instructional methods to develop new skills for students with disabilities. They have been demonstrated to be effective across a wide range of skills. As all of the methods described here employ positive reinforcement, using the procedures previously described to identify potent reinforcers is of particular importance.

#### *Shaping*

Perhaps the most fundamental teaching procedure is shaping, which is defined as the differential reinforcement of successive approximations to a terminal behavior. In other words, reinforcement is initially provided for a behavior that “approximates,” or is similar in some form to, the desired behavior. Once that behavior is reliably occurring, the criteria for reinforcement are changed, and the individual must now engage in a behavior that is a closer approximation to the final form of the desired behavior than the initially acceptable behavior. This process of gradually “raising the bar” for reinforcement continues until the desired terminal behavior is reached. For example, suppose a teacher wishes to begin toilet training with one of her students, but the student refuses to enter the bathroom. The teacher might begin by providing reinforcement (e.g., access to a preferred book) for sitting in a chair that is facing the bathroom but is 10 feet away from the door. Once this is occurring reliably, the teacher might move the chair 3 feet closer to the bathroom door, providing reinforcement when the student sits in the chair. The process would be continued as the chair is gradually moved closer and closer to the bathroom until it is placed in

the doorway and then ultimately inside the bathroom. The chair might then be removed and reinforcement provided when the student sits on the toilet with the lid down and his or her pants up, then with the lid up and pants up, then lid up with pants down, and so forth.

One of the principal advantages of shaping is that it encourages participation in the learning activity because the individual comes in contact with reinforcement early in the process and is frequently reinforced for making closer and closer approximations to the target behavior. It is important to remember, however, that the shaping process is not necessarily linear and that adjustments will often need to be made during the shaping process. For example, shaping steps may need to be made smaller or larger depending on how the student is performing. For a detailed description of shaping procedures see Pryor (1999, Ch. 2; “Shaping: Developing Super Performance Without Strain or Pain”).

#### *Prompting*

Prompting is defined as adding some type of external cue to an instructional situation to increase the probability of a correct response occurring. Prompts fall into three categories: (1) verbal, including signed and written prompts; (2) physical, ranging from partial physical to full physical; and (3) gestural, including modeling. Typically, physical prompts are considered to be the most intrusive and verbal prompts the least intrusive. Often prompts are combined, such as gestural and verbal prompts, to occasion behavior. In any teaching procedure that is selected, some type of prompting of behavior will likely be required so that reinforcement can be delivered. If the student could already perform the skill, then no teaching would be necessary. Prompting is an efficient means of “getting behavior going.” The other alternative is to wait for the behavior to occur and then reinforce when it does occur. In classic shaping procedures, this is the approach that is most often used.

There are two general procedures for prompting that can be incorporated when teaching either component skills or composite skills. One approach is a least-to-most prompting sequence. In this approach, the

lowest level of prompt is implemented, and then increasingly intrusive prompts are implemented until the desired response occurs. Least-to-most prompting sequences are often used to increase compliance with instructions. An example of instructing a student to throw some trash away is described in the sequence below:

1. Specific verbal direction to throw trash away. Student does not comply.
2. Verbal direction is repeated, and a gestural prompt of pointing toward the garbage is added. Still no compliance by student.
3. Verbal direction with gestural prompt is repeated, along with partial physical prompt of pulling student's chair back from the table. Still no response from the student.
4. Verbal direction with gestural prompt is repeated, and a more intrusive physical prompt of slightly tugging on the student's shirt is added. No response from student.
5. Verbal direction with gestural prompt is repeated, and a full physical prompt of lifting the student from the chair and guiding him or her to the garbage can is added. At this point, student complies.

Depending on where the student is in the teaching sequence, reinforcement can be added at any point of the sequence as compliance occurs. Often reinforcement is reserved for those occasions in which compliance occurs at the first step.

The other approach is to move from most-to-least prompts in which the highest level of prompt necessary to occasion behavior is implemented and then faded to less intrusive forms of prompts. This sequence is often used to teach a wide variety of self-care skills for students with developmental disabilities. An example of this procedure follows. The skill being taught is applying toothpaste to a toothbrush. The student has no ability with respect to this skill, so full physical prompts and visual prompts are used.

1. Instructor models the skill by placing an appropriate amount of toothpaste on a toothbrush while student observes. Using full physical guidance, the student is prompted to squeeze an appropriate amount onto his or her toothbrush. This level of prompting is continued until the student reliably applies

an appropriate amount of toothpaste that matches the amount on the model toothbrush prepared by the instructor.

2. The next step in the prompting sequence is a partial physical prompt, in addition to the visual model of the toothbrush. In this sequence the student applies the toothpaste with the instructor's hands very close to the student's, shadowing the student's movements so that if another partial prompt is required it can occur at the moment the student is performing the task. When an appropriate amount has been dispensed, the instructor guides the student to put the toothbrush down.

3. The next step is to fade from the partial physical prompt to simply providing the model toothbrush with the appropriate amount of toothpaste on it. The student is verbally directed to put toothpaste on the toothbrush. Once the student is reliably performing this step, then the prompt is again faded.

4. The next step in the sequence is to eliminate the visual model of the toothbrush and place a toothbrush and toothpaste in front of the student, instructing the student to put toothpaste on it. When the student is consistently performing this step, the prompt is again faded.

5. In this step, as the toothbrush and toothpaste are placed in front of the student, the instructor gives the indirect verbal prompt, "What do you do next?" When the student is consistent at this level, the indirect verbal prompt is faded.

6. The last step in this prompting sequence is to place the toothbrush and toothpaste in front of the student and wait for the student to respond. The student will have mastered this component of the toothbrushing task when the toothpaste is applied to criterion level across a specified number of trials.

When using the most-to-least method of prompting, reinforcement is provided if the student responds correctly to the instructional prompt.

With the most-to-least method, it is likely that the student will make response errors or fail to respond on some occasion. On these occasions, some type of error correction is required. In many instances the appropriate error correction is to use the next most in-

trusive prompt in the sequence to occasion correct responding. This error correction prompt may be the prompt used previously for correct responding before fading to a less intrusive prompt. Reinforcement should not be provided if correct responding occurs with the error correction. Once the error correction has produced the correct response, then the instructor should move on to the next trial so that reinforcement is once again available when correct responding occurs.

Regardless of which prompting method is used, it is necessary to remove all external prompts before the student can be considered to be independent. Toward that end, when a teaching plan is initially developed, prompt fading should be a component of the plan. The prompt fading plan should include clear specification of the criteria for changing the prompt level, the next prompt in the fading plan, and criteria for returning to a previous prompt level if performance deteriorates. Typically, the criteria for fading to the next prompt are specified as number of consecutive correct trials over a specified time period.

Ultimately, the prompting plan and prompt fading plan have to be individualized with a specific student and skill in mind. There is no universal sequence of prompts that can always be followed. There are several considerations when selecting the prompting method, the specific sequence of prompts, and the fading plan. In terms of selecting a prompting procedure, the most-to-least sequence is most commonly used to teach self-care skills. The specific sequence of prompts depends on the skill being taught and characteristics of the student. If a student is uncomfortable being touched, it may be unwise to include physical prompts. Similarly, if the student has limited vision or hearing, visual and auditory prompts will be ineffective. The characteristics of the student may limit the types of prompts that can be used, but they are not limits to effective instruction. For a more comprehensive discussion of prompting, please see Snell and Brown (2000, Ch. 4). In Figure 22.2 there is an instruction data sheet that allows the instructor to define the current instructional prompt, as well as the correction prompt. This form allows for quick analysis of the effectiveness of the teaching plan.

### **Task Analysis**

Many of the functional skills that we want to teach involve a complex sequence of steps. A task analysis is not a teaching method but rather a method for organizing how to sequence the instructional process. In the preceding section, we used applying toothpaste to a toothbrush to demonstrate how to use a most-to-least prompting sequence. Applying toothpaste is a component skill of the larger skill of toothbrushing and is of little value if the student cannot perform the remaining steps in the sequence.

There are several methods for developing a task analysis, with various levels of effort required of the instructor to generate the list of component steps (Bailey & Wolery, 1984; Horner & Keilitz, 1975; Moyer & Dardig, 1978; Wilson, Reid, Phillips, & Burgio, 1984). Perhaps the simplest method is for the instructor to perform the task and to note each discrete form of behavior that occurs (Moyer & Dardig, 1978). It is wise to perform the task several times to ensure that as many of the steps as possible are identified. It is likely that the some of the steps will have to be broken down into more discrete steps for the purposes of instruction. It is important to note the steps in as small units as possible. Following is an example of a task analysis for toothbrushing:

1. Pick up toothbrush by the handle with dominant hand.
2. Turn on cold water with other hand.
3. Holding toothbrush, place bristles of toothbrush under the water.
4. Turn off water.
5. Put toothbrush down.
6. Pick up tube of toothpaste.
7. Take cap off toothpaste.
8. Pick up toothbrush.
9. Hold toothbrush in one hand and toothpaste in other.
10. Apply appropriate amount of toothpaste onto the bristles of the brush.
11. Put toothbrush down.
12. Put cap back on toothpaste.
13. Pick up toothbrush.
14. Bring toothbrush to mouth and brush front outside surface of teeth.
15. Brush back outside surface of teeth on left side.



16. Brush back outside surface of teeth on right side.
17. Position toothbrush to brush inside surface of the teeth.
18. Brush front inside surface.
19. Brush back inside surface on left side.
20. Brush back inside surface on right side.
21. Put toothbrush down.
22. Turn on cold water.
23. Fill cup with water.
24. Turn off water.
25. Bring cup to mouth.
26. Take water into the mouth and rinse.
27. Spit water into the sink.
28. Pick up towel.
29. Wipe mouth.
30. Replace towel.
31. Place toothbrush and toothpaste in proper location.

As can be seen in this example, there are many discrete steps. In some instances the sequence is important, and in other instances the sequence is not. For example, placing the cap back on the toothpaste could be one of the last steps in the sequence, and filling the rinse cup could occur right after wetting the toothbrush. It is also likely that some of the steps will have to be reduced to even more discrete steps for the purposes of teaching. Teaching a student to rinse may require teaching the student to gargle and swish the water around in the mouth rather than swallowing it.

As a means of increasing the maintenance and generalization of the toothbrushing, picture prompts can be used in which the student is taught to follow the picture sequence when brushing his or her teeth. The picture sequence functions as the task analysis and can be used concurrently with other types of prompts to increase the probability of the student's completing each step. Time delay can also be incorporated into the teaching sequence with the picture prompts. Once a picture is presented, the instructor waits for a specified length of time before providing another prompt. The goal is for the student to become independent of adult prompts, with the picture prompts functioning as a common salient stimulus to facilitate toothbrushing in any setting in which it is required. The picture prompts can remain in place indefinitely and be used in the same

way that many of us use appointment books to manage our behavior.

### ***Establishing Behavioral Chains***

One method for teaching the skills identified in a task analysis is to consider them as a chain of behaviors, with each step in the sequence occasioning the next step. In the preceding task analysis of toothbrushing, there is a defined sequence of component skills that compose the composite skill of toothbrushing. Behavioral chains can be taught as forward chains in which the sequence of skills is taught from the first to the last component. The alternative is to teach in a backward chain, in which the last component skill in the sequence is taught first and then the next to last and so on until the entire sequence is taught. Both forward and backward chaining have been used to teach a variety of functional life skills. There is no compelling evidence to favor one method over the other (Bellamy, Horner, & Inman, 1979).

The primary advantage of backward chaining is that the student performs the last response in the chain first and immediately receives reinforcement for completing the sequence. For instance, when teaching shoe tying, the instructor would perform all of the steps except pulling the laces tight. The student is required to pull the laces tight as the last response in the chain. Once the laces are tightened, the student is praised for tying her shoes and allowed to go outside to play. Once the student has mastered pulling the laces tight, then pulling a loop through the lace and pulling the laces tight will be taught. Because the student has already mastered tightening the laces, getting to this step will function as a reinforcer for pulling the loop through the laces, and tightening the laces is reinforced by praise and going outside to play.

The primary advantage of forward chaining is that the task is taught in the sequence in which it typically occurs, and it may be that the student can perform some of the steps without explicit training. In forward chaining, it is possible to provide social reinforcement for each step correctly performed so that the student receives high rates of reinforcement during each instructional trial.

After completing a task analysis, a decision must be made about which chaining method to use. One step at a time can be systematically taught while the instructor guides the student through the rest of the sequence. This method can be used with either backward or forward chaining procedures. A total task approach is utilized only with the forward chaining method. In this approach, systematic teaching is used for each step of the sequence, and all steps are taught during each instructional session. Typically, total task approaches are used when the sequence is relatively short. The advantage is that each time teaching occurs, all steps are taught, which may result in getting to independence more quickly. However, more effort is required from the student when longer sequences of component steps are taught. This may result in increased resistance from the student toward instruction. Teaching one component at a time may reduce the overall effort required of the student during an instructional session.

When using chaining to teach a skill, it is likely that prompting will be incorporated into the instructional plan. Prompting facilitates the student's mastering of each step of the sequence and ultimately his or her being able to perform the entire skill independently. It is likely that various prompt levels will be necessary for different steps within the total task presentation sequence. One of the disadvantages of the total task presentation is that the instructor must keep in mind the appropriate prompt level and sequence for each component step in the chain. Teaching only one component step at a time may be easier for the instructor to implement, because it is necessary to remember only one prompt during an instructional session.

### **Instructional Methods**

In this section we describe specific methods for instruction that have been used to teach a wide variety of skills across all of the domains of functional life skills.

#### ***Discrete Trial Teaching***

Discrete trial teaching (DTT) is an effective, research-based technique for teaching stu-

dents new skills (see Remington et al., 2007, as a recent example of the positive outcomes produced by DTT). Although it has received a significant amount of attention recently as an intervention strategy for students with autism, it has also been shown to be effective with students with other types of disabilities (e.g., cerebral palsy, communication delays, cognitive delays; Downs, Downs, Johansen, & Fossum, 2007). The basic logic of DTT involves presenting students with repeated opportunities to practice specific skills and to receive feedback and reinforcement from an instructor based on their performances. These opportunities to practice skills and receive feedback and reinforcement are called "discrete trials." The basic structure of each discrete trial is as follows: (1) the teacher obtains the student's attention, (2) the teacher presents an instruction, (3) the teacher waits for the student to respond to the direction and provides additional assistance in the form of prompts if necessary, and (4) the teacher provides a consequence based on how the student responds (reinforcement for correct responses, corrective feedback for incorrect responses).

It is important to gain the student's attention before delivering an instruction, both to increase the probability that the student will respond correctly and to allow the instructor to differentiate between errors made because the student was not paying attention or because he or she does not know how to perform the correct response. Eye contact, either with the instructor or with the instructional materials, has commonly been used as a means of determining whether a student is attending and is ready to receive an instruction. Whereas some students may readily give eye contact, others may need prompting to do so. Various strategies, including saying the student's name, giving a light touch to the cheek, or giving an attending instruction such as "look," have been used to gain eye contact (see Higbee, 2009, for a detailed discussion of methods of teaching attending skills).

Once the student is paying attention, the next step in DTT is to provide the student with an instruction and an opportunity to respond. When teaching new skills to students, instructions need to be simplified to promote correct responding (e.g., "brush

teeth” instead of “Can you please come over here and brush your teeth?”). Once the student is consistently responding correctly to the instruction, it can be made more complex and naturalistic. It is important to avoid repeating instructions in DTT. Each instruction is presented only once, and a consequence must be provided before the student is given another opportunity to respond. This teaches students that it is important to pay attention to the first instruction rather than waiting for it to be repeated. As a general rule, students should be allowed up to 5 seconds to respond to the instruction.

The student can give one of three responses to an instruction: correct, incorrect, or no response (which is also incorrect). Following a correct response, the instructor should provide praise, as well as additional reinforcement based on the needs of the student. Incorrect or nonresponses can be given a variety of different consequences depending on the individual student. One approach is to provide brief verbal feedback using a neutral phrase such as “try again.” Another approach is to avoid saying anything, break eye contact for a few seconds, and then represent the next instructional trial. Error correction procedures in which the student is prompted to make the correct response can also be added to either approach. Recent research by Worsdell and colleagues (2005) suggests that error correction procedures in which the student is prompted to repeat the correct response several times in succession may be more effective than repeating the correct response once.

Although DTT has often been used in relatively sterile, highly structured instructional environments in which distractions are minimized for the student, such an environment is not a requirement of this approach. DTT can be used to teach a variety of skills in educational, vocational, leisure, and home environments. Strategies to promote generalization of skills learned through structured DTT teaching include: practicing the skill in multiple locations, including the contextually appropriate location for using the skill (e.g., after learning to identify coins in a DTT preparation, practice selecting the appropriate coins for use in a vending machine); practicing the skill with multiple instructors; and using multiple examples

during teaching (e.g., when teaching an individual to recognize restroom signs, use several different restroom signs as examples, including text signs and symbol signs).

One important strategy for promoting maintenance of skills learned during DTT is called *interspersal*. Interspersal involves mixing trials of skills that have been mastered with trials of new skills. It has the dual purpose of keeping the student in contact with reinforcement by providing him or her with opportunities to respond to skills he or she has mastered while simultaneously providing additional practice on the mastered skill to promote maintenance. Research on interspersal has shown that once a skill has been mastered, fewer trials are required to maintain it at acceptable levels of performance (Neef, Iwata, & Page, 1977, 1980).

### *Incidental Teaching*

Incidental teaching is often characterized as child-led instruction (Hart & Risley, 1975; Koegel, Koegel, & Surratt, 1992) and has also been described as naturalistic teaching (Laski, Charlop, & Schreibman, 1988). Instruction is embedded into naturally occurring routines and interactions with adults, such as mealtimes and play periods. The instruction is considered to be child-led because the instruction occurs during an activity in which the child is showing interest and is already participating. Because of the child's interest in the activity, it is possible that the child's motivation is very high, so some of the problems of reinforcer identification are minimized. For example, if a child picks up a car during play, many goals can be taught using the car as the stimulus for teaching. The adult can briefly block play until the child names the color of the car, identifies whether it is large or small relative to another toy, or identifies the shape of the wheels. Similarly, if the goal is to learn to tie shoes, then each time the student goes outside, he must change into outside shoes and practice tying the laces. The reinforcer is going outside. The chaining and prompting methods described earlier can be incorporated into the teaching to ensure efficient learning.

The term *incidental teaching* can be a bit misleading in that it can be interpreted as

a laissez-faire approach in which adults just wait around for the child to show an interest in an activity or routine. Effective incidental teaching encourages a high level of engagement by setting up the environment with interesting materials for the student. Different activities and routines can be arranged to teach specific skills. The activities and materials that are available to the student are selected with the instructional goals in mind and are routinely changed to facilitate generalization of the skill across different stimuli. For example, if the goal is to teach a child to ask for help, the environment can be set up in several ways to increase the motivation to ask for help. Preferred materials can be placed out of reach; tasks that require the assistance of a second person, such as moving something heavy, can be assigned; preferred items can be placed inside a jar with the lid on so tightly that the student cannot open it without assistance; and doors and cabinets can be locked so that it will be necessary for the student to ask for help to gain access. All of these efforts can be seen as increasing the motivation for the student to gain access to preferred activities for which only effective means is to ask for help.

One of the demands on the instructor using incidental teaching is to identify relevant "teachable moments." The task of the instructor is twofold. First, the instructor must provide the appropriate level of prompting and coaching to ensure student success at the task. This requires the instructor to be aware of where the student is in the instructional process on all of the skills that are being taught and to be able to provide the current teaching prompt and error correction if necessary. The second task for the instructor is to briefly obstruct access to preferred activities and routines until the correct performance has been demonstrated. If the obstruction lasts too long or the response requirement is too great, the student is likely to engage in problem behavior associated with the loss of reinforcement.

Although incidental teaching may minimize motivational issues, one of the challenges that instructors face with incidental teaching is ensuring that a sufficient number of learning trials occurs so that a skill can be learned as quickly as possible. One approach is to use analogue instructional methods such as discrete trial training to

facilitate initial acquisition of the skill and then use incidental teaching methods to facilitate maintenance and generalization.

Incidental teaching effectively promotes generalization because many of the stimuli used during instruction are encountered across settings and contexts (Hart & Risley, 1980; McGee, Krantz, & McClannahan, 1985). The nature of incidental teaching minimizes the need for planning for generalization. Regardless of the teaching method selected for initial acquisition, at some point the teaching must move to the natural environment, and the methods of incidental teaching will become relevant.

### *Video Modeling*

Video modeling is an instructional technique that is being used more commonly with individuals with autism and other developmental disabilities. In video modeling interventions, footage is created that depicts one or more individuals engaging effectively in a sequence of behaviors (the video model). The learner views the videotape or DVD and is given the opportunity to imitate the behavioral sequence. Video modeling procedures have been used to successfully teach learners with autism and related disabilities a variety of skills, including perspective taking (e.g., Charlop-Christy & Daneshvar, 2003), language (e.g., Charlop & Milstein, 1989), daily living skills (e.g., Charlop-Christy, Le, & Freeman, 2000), play (e.g., D'Ateno, Mangiapanello, & Taylor, 2003), and academic skills (Kinney, Vedora, & Stromer, 2003). Researchers have shown that participants rapidly acquire the target skills and demonstrate skill maintenance over long periods of time (e.g., Charlop & Milstein, 1989).

Technological advances have made video modeling more accessible by decreasing the cost and level of expertise necessary for creating video models (e.g., Charlop-Christy et al., 2000). All that is now required is a digital video camera and a computer with a DVD burner and basic video editing software (often included in software packages shipped with new computers). Of course, sufficient time, patience, and motivation to learn how to use the camera and video editing software are also required.

In addition to cost- and time-effectiveness, there may be several potential advantages to



using video models to teach students with disabilities. One potential advantage is the systematic repetition and consistency of instruction that can be provided by having the learner view the same video model numerous times (Charlop & Milstein, 1989; Taylor, Levin, & Jasper, 1999) in contrast to using *in vivo* modeling, which can include small behavioral variations in the performance of the live models each time the target behavior is modeled for the learner. Video models can conveniently employ strategies that help promote generalization, such as programming multiple exemplars, incorporating common stimuli, and training using natural contingencies and environments by arranging these instructional features in the creation of the video model (e.g., Charlop & Milstein, 1989). Finally, videotaping may also facilitate the use of a variety of models that might not be available for repeated live modeling trials, such as typical peers (Nikopoulos & Keenan, 2003), siblings (Taylor et al., 1999), and the learner him- or herself (Wert & Neisworth, 2003).

### Evaluating Progress

Inherent in effective instruction is the systematic evaluation of student progress. Ongoing measurement helps practitioners optimize their effectiveness and ensures that teaching programs are not terminated prematurely because subtle improvements in student performance are not readily apparent nor continued indefinitely when the student is clearly not making sufficient progress.

As the range of skills falling under the heading of “functional life skills” is quite broad, no one data collection system would be universally appropriate. Critical features of high-quality data collection systems allow the practitioner to track the accuracy of student performance and his or her level of independence (e.g., prompt levels). As important as it is to collect data on student behavior, it is useful only to the extent that it is analyzed and used to inform practice. Accurate data collection is a means to an end and not an end unto itself. Graphical data displays, particularly line graphs, can help practitioners to make sense of their data and make appropriate data-based decisions. Whether graphs are created using computer software

or handwritten is relatively unimportant, so long as the data are accurately represented in a way that allows the practitioner to evaluate the level (in general, how high or low the data are), trend (the general slope up or down in the data), and variability (the “bounce” or range of scores) in the data. See Daly et al., Chapter 29, this volume, for a more detailed discussion of evaluating outcomes, including summarizing data.

### Conclusion

In this chapter we have tried to highlight the fact that effective instruction for students with disabilities requires consistent and systematic instruction that takes advantage of one or more of the methods described. The constant across all methods is that reinforcement has to be consistently provided for approximations to correct responses if learning is to progress. There are many variants to the methods that we have described in this chapter. They reflect that, ultimately, instructional methods have to be adapted to the individual student and the circumstances in which the student is being instructed. Effective instruction involves continuous evaluation and revision until the student is making measurable progress toward the greatest level of independence possible. If there is no progress, then there has been no teaching.

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