

DISCRETE TRIALS TEACHING

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The advantages of emphasizing discrete trials *teaching* over discrete trials *training* are presented first, followed by a discussion of discrete trials as a method of teaching that emerged historically—and as a matter of necessity for difficult learners such as those with autism—from discrete trials as a method for laboratory research. The elements of discrete trials teaching are presented next, and after that a set of guidelines for discrete trials teaching is given and elaborated upon. A final note on deciding what to teach and how best to teach it concludes the article. © 2007 Wiley Periodicals, Inc.

Great strides have been made in the education and treatment of young learners with autism in recent years. Many of the advances can be attributed to Applied Behavior Analysis (ABA), particularly as it pertains to developing and refining various methods of teaching. Of the methods, one of the oldest and most widely known and practiced is popularly called discrete trials training, or simply DTT.

The discrete trials method of teaching is controversial. Inside ABA, the controversy has nothing to do with the efficiency and effectiveness of the method, but rather with how it is so often inaccurately portrayed in fields outside ABA. The first part of this article explores some of the main points of the controversy. The aim is to foster a more accurate view of discrete trials teaching to educators working outside of ABA who have an intellectual or practical interest in the method.

The second part of this article is given to more applied matters. The elements of discrete trials teaching are described first, followed by a list of guidelines for how to use the method. The article ends with some brief comments on what to teach and on selecting the most appropriate method or combination of methods for a given learner.

Although the focus throughout is on young learners with autism, it is important from the outset to understand that discrete trials teaching is by no means limited to that population. Instead, the method can be used with *all* learners, regardless of their age or level of development.

BRIEF REVIEW OF LITERATURE: APPREHENSION AND MISREPRESENTATION

A common apprehension among behavior analysts is to regard discrete trials teaching as discrete trials *training*. One problem with the word *training* is that it implies establishing a skill or what philosophers (e.g., Ryle, 1949) and psychologists (e.g., Baum, 2005) call procedural knowledge. This type of knowledge can be thought of as knowing how to perform some action, for example, riding a bike, flying a kite, or hammering a nail. A second type of knowledge is called declarative knowledge. This type of knowledge can be thought of as knowing about some person, object, or event, for example, the color of a person's eyes, the shape of a baseball field, or the flavor of a particular ice cream. A third type of knowledge, called self-knowledge, can be thought of as knowing about one's self, for example, one's love of reading, distaste for politics, or fear of cats.

The point of drawing these distinctions is that discrete trials is not limited to training a learner the sorts of how-to skills that comprise procedural knowledge. The method can also be used to

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teach declarative knowledge about the world of people, objects, and events as well as knowledge about one's own thoughts, beliefs, feelings, and attitudes.

Another apprehension about *training* is that the word is sometimes used in the pejorative sense of obedience training for pets and performance training for circus animals and marine life. Discrete trials methods are widely used for those purposes; however, the false impression is that children with autism and nonhumans are the same in how they learn and how they should be taught. Regrettably, the affect is often to dehumanize the child or to regard what a child learns as nothing more than a trick or rote act that appears on command. To a parent, this can be disheartening, and to a teacher, demoralizing.

It is for those two reasons that behavior analysts are apprehensive about the term discrete trials *training*. Instead, the more inclusive and less controversial discrete trials *teaching* is the preferred term. This emphasis on teaching has the added advantage of including discrete trials among all other ABA methods that collectively constitute a technology of teaching (Skinner, 1968).

The widespread misrepresentation that discrete trials teaching is synonymous with ABA poses another problem for behavior analysts (Baer, 2005). It is easy to correct this by drawing attention to the fact that discrete trials is only one of many teaching methods used by behavior analysts. Other methods include precision teaching (e.g., Binder, 1996), incidental teaching (Fenske, Krantz, & McClannahan, 2001), pivotal response teaching (e.g., Koegel & Koegel, 2006), and natural environment teaching (e.g., Sundberg & Partington, 1999), to name just a few. (See Cowan & Allen, 2007, in this special issue, for a review of these teaching methods). The point here is that no *one* method of teaching is synonymous with ABA.

The problem of equating ABA with discrete trials takes on added significance when the method is viewed historically as a research method or as a method of teaching. As a research method, the origin of discrete trials is *not* in behavior analysis, but rather in the methods that were popular in experimental psychology well before the dawn of behavior analysis in the 1930s (Skinner, 1979) and well before the birth of ABA in the 1960s (Baer, Wolf, & Risley, 1968).

The historical fact is that a growing dissatisfaction with the discrete trials research methods of Pavlov, Thorndike, Watson, and Hull led directly to Skinner's development of the free-operant method (Bjork, 1993, p. 93ff.; Skinner, 1956). In this method, the subject is "free" to respond at any time, for example, by repeatedly pressing a lever or striking a key. The rate at which the response occurs constitutes the dependent measure. This differs sharply from discrete trials research methods in which the subject is permitted to respond only once on any given trial, for example, by turning left instead of right in a T-maze. The dependent measure is ordinarily the percentage of trials in which a subject makes a response that is correct or appropriate to the experimental situation.

Skinner's free-operant method quickly became one of the defining features of behavior analysis, and to this day remains the epitome of research in both the experimental and applied branches of the field. Cast in this light, then, it would be easier to argue that the discrete trials method, rather than being synonymous with ABA, is actually antithetical to it (see Lindsley, 1996).¹

How discrete trials as a research method developed over time into discrete trials as a teaching method goes back to the early days of ABA. According to Lindsley (1996), it was Bijou and his colleagues and students at the University of Washington who turned to discrete trials in the late 1950s and early 1960s as a way to teach young children with retardation in the classroom. The

¹Although research in the experimental and applied analysis of behavior is primarily free-operant, many examples exist of employing discrete trials methods, for example, in the study of choice and conditioned reinforcement, conditional discrimination, and stimulus equivalence.

inspiration for this, according to Risley (1999), was the Wisconsin General Test Apparatus (see Bijou & Baer, 1960; House & Zeaman, 1958), a table-top device commonly used at the time to study visual discrimination learning with young children under strict laboratory conditions. Risley described the device as “very Hullian” in that it mirrored the discrete trials research method used by Clark Hull in his experiments on discrimination and choice learning in maze-running rats in the 1930s and 1940s. The main idea behind transforming discrete trials research into discrete trials teaching was to achieve the same degree of control over teacher–learner interactions that was achieved over experimenter–subject interactions.

A classic study in the 1960s by researchers at the University of Washington (Wolf, Risely, & Mees, 1964) stands out as not only one of the first in ABA, but also as one of the earliest demonstrations of discrete trials teaching. At first, the free-operant method of successive approximations (response shaping) was used with a visually impaired young boy with autism, Dicky, who refused to wear his glasses. Once he was wearing them throughout the day, Wolf and his colleagues turned to Dicky’s deficient verbal–vocal behavior. Shaping was tried initially, but because he seldom responded vocally on his own, it was deemed too difficult and time-consuming for his teacher to wait for a vocal response to occur and to then supply a reinforcing consequence quickly enough to produce more or improved vocal responses. The decision was then made to temporarily abandon shaping in favor of discrete trials teaching. Wolf and his colleagues began first with vocal imitation of sounds, blends, and whole words, and then moved on to a combination of discrete trials and shaping methods to teach Dickey more sophisticated forms of verbal behavior and interpersonal interaction.

A final note on the relation between ABA and discrete trials teaching pertains to the pioneering work with young children with autism by Lovaas and his colleagues (Lovaas, 1987). In recounting his early work on language development with preschool children at the University of Washington in the late 1950s, Lovaas (1993) credits Bijou and his colleagues and students with helping him bridge “the gap between behavioral psychology and clinical application” (p. 618). Then, as now, Lovaas (1971, 1981, 2003) was a strong proponent of discrete trials teaching, but always in combination with free-operant methods such as shaping.

We now turn to more practical matters pertaining to discrete trials teaching. The elements of discrete trials teaching, a list of guidelines on how to use the method, and a few closing comments on how to teach, what to teach, and when to use a given teaching method round out the article.

APPLICATION I: THE ELEMENTS OF DISCRETE TRIALS TEACHING

The essence of discrete trials teaching is control over the teaching situation. What this means is that the learner is given limited opportunities to respond, and that those opportunities are managed entirely by the teacher in terms of what happens before, during, and after the learner responds in a learning task. In the prototype example with a young learner with autism (Lovaas & Buch, 1997), the teacher starts a discrete trial by giving one instruction (e.g., “Sit down.”) to which the learner makes one response (e.g., he or she sits down). Then, depending upon how accurate or appropriate the learner’s response was to the teacher’s instruction, the teacher either provides a positive consequence (e.g., a pat on the back) or withholds a positive consequence (e.g., withdraws attention).

Providing or withholding a positive consequence marks the end of a teaching trial and the start of a brief period of time, called an intertrial interval (or ITI for short), that separates each trial from the next trial. The length of the ITI and what takes place during this time are also controlled by the teacher. At the end of the ITI, a new trial begins that is ordinarily a repetition of the instruction given by the teacher to the learner on the immediately preceding trial. A brief ITI

follows that trial, the next trial begins, and so forth for as many trials as the teacher schedules for a given learning task.

The inclusion of an ITI is a defining feature of discrete trials teaching. This feature also distinguishes discrete trials from free-operant methods such as shaping where the teacher's interaction with a learner has no explicit beginning or end. (Because the learner's response to a teacher's instruction is under his or her control, the term "controlled operant" is sometimes used to identify discrete trials and to differentiate it from free-operant teaching methods; Lindsley, 1996).

Another sense of the control afforded by discrete trials teaching is that the learner's response can often be easily supplied by providing a response prompt. In the prototype case of teaching a learner to sit down on a chair when instructed to "Sit down," the teacher may gently but firmly lead the learner to a seated position in a chair and then provide a positive consequence for attending to and complying with the instruction. The advantage here is that the learner is immediately successful in following the teacher's instruction and that a positive consequence follows the learner's response. The likelihood that the learner will attend to and abide by the same or a similar instruction given by the teacher on future trials is thereby enhanced.

An especially attractive feature of discrete trials teaching is how well it fits with what behavior analysts call the three-term contingency (Pierce & Cheney, 2004).² This contingency relates the learning process to three basic elements—a stimulus, a response, and a reinforcer. In the technical vocabulary of behavior analysis, the stimulus is called a discriminative stimulus or "Sd" for short. Discriminative stimuli can be thought of in a practical sense as a collection of antecedent techniques that a teacher uses *before* a learner makes a response in a learning task. This includes posturing the learner, getting his or her attention, giving instructions, and prompting to facilitate the required response.

Antecedent techniques serve two important purposes: They cue or set the occasion for the learner to attend to and follow an instruction, and they signal to the learner that if he or she gives a response that is correct or appropriate to the instruction, a reinforcing consequence will follow. In the prototype example given above, the teacher's instruction is a cue to the learner to "Sit down." The learner gives a response to the teacher's instruction, and then, depending upon how quickly or appropriately the learner sat down on the chair, one of two things happens: The teacher either supplies or withholds a reinforcing consequence.

Only those consequences that actually increase the likelihood of the learner attending to and following the teacher's instruction on future trials can be called reinforcing. That is, it is necessary to show that the learner's response to an instruction is more accurate or correct on subsequent trials than it was on previous trials. It is also necessary to show that this improvement is due to the reinforcing effects of the consequence that followed the learner's response. Alternatively, when a reinforcing consequence is withheld for an inaccurate or incorrect response, it is also necessary to show that withholding that consequence leads to a reduction in the learner's inaccurate or incorrect response on future trials.

This point is especially relevant to a young learner with autism for whom spending time away from the teacher and the teaching situation is preferred over spending time in the situation with the teacher. If the teacher praises the learner for a correct response to an instruction and alternatively ignores the learner by briefly looking away after he or she gives an incorrect response, care must be taken, first, to ensure that praise is reinforcing the correct response, and second, to ensure that

²Modern formulations of the three-term contingency regard it as the "N-term contingency" to acknowledge the contribution of other factors important to the analysis of behavior, for example, motivating operations and conditional stimulus control (Michael, 1993, 2000).

by ignoring the incorrect response, the teacher is *not* reinforcing it by giving the learner a preferred consequence, which is time away from the teacher and the demands he or she places upon the learner to attend to and comply with an instruction.

We now turn to a list of guidelines for discrete trials teaching. The guidelines are general, as opposed to specific, and lean heavily toward knowing how to use the method instead of knowing about the method. Some of the guidelines are peculiar to discrete trials teaching, whereas others are applicable to all ABA teaching methods. Accordingly, the guidelines are taken from many sources, including various how-to manuals (e.g., Lovaas, 2003), research articles (e.g., Koegel, Russo, & Rincover, 1977), textbooks on ABA (e.g., Alberto & Troutman, 2006; Miltenberger, 2004), and textbooks on the basic principles and concepts in behavior analysis (e.g., Catania, 1998; Pierce & Cheney, 2004). (The reader is advised to consult these and other similar sources for additional details or more expansive coverage on knowing about and knowing how to use discrete trials teaching.)

APPLICATION II: GUIDELINES FOR DISCRETE TRIAL TEACHING

Discrete trials is no different from any other teaching method in that both the learner and the learning environment must be prepared for success. What this means is that the learner is in good health, is in a sanguine emotional state, and is well rested. It also means that the learner and the teacher have a good rapport, which is an essential condition for making reinforcers effective and for developing a favorable disposition toward learning.

The teaching environment should be pleasant and appropriate to the skills or abilities being taught. Also, care must be taken to remove distracting influences that may interfere with responding to the teacher's instructions. This may include eliminating certain sights (e.g., pictures on the wall, toys and books on the floor, brightly colored or multipatterned clothing and shiny jewelry worn by the teacher) and sounds (e.g., television, radio, telephone, conversations, children playing indoors or outside) that compete with the teacher for the learner's attention. This is especially important for young learners with autism in the early stages of teaching. Later on, distractions may be added to ensure that the learner remains attentive to the teacher.

With those preliminary steps out of the way, the next step is to begin discrete trials teaching by following the guidelines contained in Table 1. The guidelines are organized (under Event) according to what the teacher says or does on a given teaching trial (a) before the learner responds (Antecedent), (b) when the learner responds (Response), (c) immediately after the learner responds (Consequence), and (d) at the end of a trial (Intertrial Interval).

Antecedents

All of what a teacher says and does before a learner makes a response in a learning task constitutes the antecedent event(s). Included here is preparing the learner for an upcoming trial by properly positioning his or her body and orienting his or her head and eyes toward the teacher and the instructional materials. Once that is achieved, an instruction is given while the learner is attending to the teacher, for example, by making or sustaining eye contact. The instruction is always given in a language (e.g., a spoken word, phrase, or sentence) that the learner understands, is always enunciated clearly, and is always presented succinctly.

A succinct instruction means that the teacher uses the minimal number of words or gestures necessary for the learner's response. For example, if a learner is being taught to discriminate a red circle from a blue one, it is best to simply instruct him or her to "Touch the red circle." rather than say "Let's see what a smart little student you are by showing me the difference between a red and a blue circle by touching the red one instead of the blue one." The point here is that a learner with limited verbal skills is unlikely to learn when too much "patter" occurs. It is far better for the

Table 1
Guidelines for Discrete Trials Teaching

Event	Guideline
Antecedent	<ol style="list-style-type: none"> 1. Position the body and orient the head and eyes 2. Gain attention while giving an instruction 3. Give an understandable, clear, and succinct instruction 4. Present instructions consistently at first, then vary 5. Supply prompt(s), as needed 6. Fade prompts, as appropriate
Response	<ol style="list-style-type: none"> 1. Select a target response 2. Define the target response in observable terms 3. Determine how the target response will be measured 4. Keep continuous objective records of the target response
Consequence	<ol style="list-style-type: none"> 1. Assess reinforcers often 2. Give a reinforcer contingent on the target response 3. Withhold a reinforcer for an incorrect response 4. Reinforce the target response immediately 5. Reinforce continuously, then intermittently 6. Utilize natural reinforcers
Intertrial Interval	<ol style="list-style-type: none"> 1. Keep the ITI distinct from the preceding and subsequent trials 2. Pause 3–5 s before beginning the next trial

teacher to use a few well-chosen words to convey to the learner precisely what is required in the learning task.

As a rule, it is always best to present instructions consistently. That is, deviations in what the teacher says or does from one trial to the next is ill advised, especially when the learner is acquiring a new response. As the learner is better able to respond, the instruction may vary from one trial the next as a way of achieving the same response when given a slightly different instruction. For example, in teaching a learner to say his name, the initial instruction may be a very deliberately and consistently spoken “What is your name?” That instruction may eventually give way to a consistent but slightly less deliberate “What’s your name?” and finally to the more colloquial “Whatsyername?” It is in this way that a learner’s response (he or she says his or her name) is ultimately enhanced in relation to variations on questions of this sort that are so often encountered in the natural social environment.

Also when teaching a new response, it may be necessary to emphasize certain words or phrases in an instruction, for instance, by altering loudness or intonation. For example, in teaching a learner to discriminate a big toy truck from a small one, the teacher may say “Touch the BIG truck.” as a way to draw the learner’s attention to that property of the truck. As the learner becomes adept at discriminating a big toy truck from a small one, the teacher may reduce the emphasis on “BIG” to the point where the instruction is given in a normal tone of voice.

The technique of emphasizing certain words, phrases, or gestures and then fading out the emphasis is an example of prompting and prompt fading. Although the practice is common in discrete trials teaching, it is by no means unique to it. In fact, all behavior analytic methods of teaching take advantage of the technique as a way both to minimize incorrect responses and to maximize correct responses.

Prompting and prompt fading. The point of prompting is to help a learner give a correct response to an instruction. A prompt is provided by a teacher whenever a learner gives an incorrect response to an instruction and is most effectively supplied while the same instruction is presented on the very next trial.

A reinforcing consequence is always given following a prompted response. However, the consequence is ordinarily smaller for a prompted response than it is for an unprompted response. There are two reasons for this practice: First, it allows the teacher to reserve a larger, longer, or more highly preferred reinforcer for a response that was made with no or relatively little assistance, and, second, it helps prevent the learner from becoming dependent on the prompt. It is important to keep in mind that prompting is always a means to an end. That is, teaching is never complete until a prompt is either completely faded or faded to a point where the learner's correct response to an instruction is occurring reliably.

There are several ways to prompt a correct response. When a teacher says something to the learner that helps him or her make the response, the teacher is supplying a verbal prompt. Verbal prompts take many forms, including instructions, rules, hints, reminders, and questions, and can be used with many responses, both verbal and nonverbal. To take a relatively simple verbal example, in teaching a learner to give a vocal naming response to a picture of a cat, the teacher may ask the learner, "What is it?" and then quickly give the beginning sound ("ca") to help him or her make the correct response ("cat"). Fading a verbal prompt of this sort is ordinarily a matter of reducing the amount of the spoken assistance, in this example, by shortening the sound from "ca" to "c."

When a teacher moves or gestures in some way that leads to a correct response, he or she is giving the learner a gestural prompt. Gestural prompts can be especially helpful when teaching nonverbal responses such as those that are involved in many self-help skills. For example, in teaching a learner how to brush his or her teeth, a teacher may point to the toothpaste container to encourage placing the toothpaste on the toothbrush, this while the learner holds the toothbrush and grips it firmly in his or her hand. Fading a gestural prompt is often a matter of diminishing the vigor with which it is given, in this case by moving from an exaggerated movement of the arm and hand toward the toothpaste container to one that is less exaggerated.

When a teacher shows a learner how to perform a response that is then imitated, he or she is presenting a modeling prompt. These prompts are extremely useful in teaching verbal and nonverbal responses. Indeed, the ability to imitate a model's words and actions is widely regarded as a hallmark in a young child's development (Bijou & Baer, 1978). Given that many young learners with autism have trouble imitating a model, it is often necessary to teach imitation first. Once a learner is able to imitate a model consistently, modeling can then be used to prompt an endless variety of verbal and nonverbal responses.

Modeling is often helpful in teaching a learner how to play appropriately with toys. For example, the teacher may say, "Do this" to prompt a learner to attend to and follow his or her actions in constructing a tower with blocks. Fading a modeling prompt is ordinarily a matter of reducing the amount of reinforcement for imitating a modeled response while concurrently increasing the amount of reinforcement for responses that occur without the model prompt.

Yet another way to prompt a correct response is to physically guide it. These are called manual prompts that involve the teacher executing all or part of the response with the learner. A manual prompt often includes hand-over-hand assistance, as may be the case in teaching a learner how to tie a knot. At first, the teacher may lay his or her hands upon the learner's hands and gently put the learner through the motions of tying a knot. As the learner becomes more competent at this skill, the teacher may fade assistance, for example, by reducing pressure or removing his or her

hands entirely whenever the learner shows that he or she can independently perform some or all of the steps involved in tying a knot correctly.

How much assistance a learner needs to make a correct response can often be determined by probing the response. As a rule, the least intrusive prompt (e.g., a verbal prompt) should be tried first, and if that fails to produce the correct response, the teacher resorts to the next most intrusive prompt (e.g., a model prompt) that is appropriate to the task, and so on, until the learner is able to respond correctly at that level of assistance. This “least-to-most” method of increasing the intrusiveness of a prompt is closely tied to errorless learning (see Mueller et al., 2007, in this special issue for a review of errorless learning) and is the recommended strategy for teaching a new response.

It bears repeating that the purpose of prompting is to assist the learner in responding correctly to a given teaching task, and that the purpose of prompt fading is to reduce and eventually eliminate all or at least most of the teacher’s assistance as soon as possible. In other words, prompt fading helps ensure a learner’s steady progression toward responding as correctly and independently as he or she is able. Continuing to prompt a response longer than necessary encourages dependency on the teacher’s assistance and thus may be counterproductive to the goal of establishing as many independent responses as possible.

Responses

It is essential from the outset that the teacher select a target response, that is, the response that he or she will require the learner to make after giving an instruction. In selecting a target response, it is important to be sure that the learner can make the response. For example, if the target response involves pointing to a shoe after the teacher gives the instruction, “Point to shoe,” then the learner must first be capable of pointing when instructed to do so. If the learner has yet to learn this, then pointing would be selected as the target, and once that response is well learned, it could then be related to a shoe or to any other object the teacher brings to the teaching situation.

In the same way, instructing a learner to make a verbal response without the prerequisite ability to speak is bound to fail. In this case, the learner must first be taught to speak, for example, by using the prompting and fading technique of verbal modeling. Once learned, a wide variety of sounds, words, phrases, and sentences can then be required in a learning task.

Distinguishing between nonverbal and verbal responses is always helpful in selecting a target response. Will the teacher’s instruction require a verbal response from the learner? A nonverbal response? Or a combination of both types of responses? In short, exactly what will the learner do after the teacher has given an instruction? Answers to those questions are important starting points in teaching, regardless of whether discrete trials or another teaching method is used.

Selecting a target response helps eliminate ambiguity about whether or not the response has occurred. There are two reasons why this is important: First, it ensures that the teacher is consistently requiring the learner to make the same or a similar response on each trial, and, second, it conveys to the learner exactly what response(s) the teacher requires.

It is extremely important to define the target response in observable terms. A good test of this is whether or not a complete stranger, armed only with a definition of the response, can easily and consistently identify when the learner has, and has not, made the required response. This is best achieved by defining the response with action words, that is, verbs. Pointing, touching, showing, and giving are nonverbal actions; saying the names of classmates, singing the alphabet, reading orally, and reciting the days of the week are verbal actions. Regardless of their type or form, the key to eliminating ambiguity is to insist upon observing the learner actually perform the actions that constitute the target response.

Nonverbal responses such as pointing, touching, showing, and giving are relatively easy to define and observe. However, given the emphasis in discrete trials teaching on judging whether or not the response is correct, care must also be taken to decide precisely what constitutes a correct response. To use a simple example, if pointing is the target response to the instruction, "Point to red," then it must be clear that a correct response involves moving the arm and hand to the red object and then pointing at it with the index finger.

Verbal responses such as imitating sounds and words, naming colors and shapes, counting out loud, and stating what was eaten for breakfast are also relatively easy to define and observe. Yet it is sometimes difficult to judge whether or not the response is correct. For example, if describing the actions of a horse is the target response to the question, "What is the horse doing?" then it must be clear that a correct answer would include "running," "galloping," "trotting," and the like.

Defining a target response in directly observable action verbs also helps to determine how the response will be measured. How frequently a response occurs, the amount of time it takes for a learner to reach a learning criterion, and the percentage occurrence of correct responses constitute the three basic ways that a teacher can measure a learner's response to a teaching task. Of these, the percentage occurrence of correct responses is the cornerstone measure of learning in discrete trials teaching. For example, if a teacher wishes to see how many colors a learner named correctly over 10 consecutive trials, the number of correct responses on each trial would be recorded and then divided by the total number of trials, in this case, 10. This measure yields the percentage of correct responses.

Consequences

We mentioned previously that a positive reinforcer is any consequence that increases the likelihood that the response that produces it will recur. We also alluded to the requirement that the relation between a response and its consequence must be demonstrated before it can be stated with confidence that a given consequence is in fact reinforcing the response. It follows, that a teacher cannot identify with certainty what will and will not serve as a reinforcer without first demonstrating its effect on a learner's response.

Locating a reinforcer that actually reinforces can be achieved in several ways, including (a) asking the learner to state what he or she would like to have or to do, (b) showing the learner several things that he or she can have or do and then requiring him or her to choose one object or activity, and (c) observing the learner playing with an object such as a toy or engaging in an activity such as jumping on a trampoline and then noting how much time he or she spends with the object or in the activity. In all cases, the assumption is that the object or activity selected will most likely serve as a reinforcer when brought into the teaching situation.

Once a potential reinforcer is identified, it must then pass the test that it is in fact reinforcing a correct response. If that is indeed the case, then care must be taken to ensure that the reinforcing consequence continues to have the intended effect. Reinforcers often lose their effect when presented frequently or for long periods of time; thus it is always good practice to reassess reinforcers on a regular basis. This is ordinarily done by repeating the process described above for identifying potential reinforcers.

Reinforcers are most effective when they are given when the learner performs a target response. In other words, give a reinforcer contingent on the target response. What this means is that there is a strict "if . . . , then . . ." relationship in place between what the learner says or does and what the teacher does or says in return; if the response is correct, then a reinforcing consequence will follow.

By the same token, if the learner's response is incorrect, then no reinforcing consequence will follow. In other words, withhold a reinforcer for an incorrect response. This is ordinarily done by

the teacher calmly and quietly removing whatever materials he or she is using from the learner's view and placing his or her head down without looking at, talking to, or otherwise interacting with the learner for about 5 s. As noted above, this procedure may need to be modified if removing attention serves as a reinforcer for incorrect responding.

It is always good practice to reinforce the target response immediately. The advantages of this are twofold: First, it conveys to the learner that there is a consistently close temporal relationship between his or her response and the consequence that follows it, and, second, it avoids the problem of inadvertently reinforcing an undesirable response such as fidgeting, whining, or crying that may intervene between a correct response and a delayed reinforcer.

In addition to providing a reinforcer immediately after the learner makes a correct response, it is also important that the reinforcer be given on a continuous basis, that is, each and every time the learner responds correctly. Enforcing this one-to-one relationship between a response and a reinforcer is especially critical when the learner is acquiring a new response. Once the response is better established, the teacher may begin providing a reinforcing consequence for some, but not all, responses.

Although it may seem counterintuitive to the practice of providing a reinforcer contingently, immediately, and continuously, the fact is that a well-learned response is most likely to endure over long periods of time when it is reinforced occasionally. This is essentially what is meant by reinforce continuously, then intermittently.

One precaution here is to thin reinforcers gradually. That is, care must be taken to move slowly from continuous to intermittent reinforcement. If this is done too quickly, the relation between the number of correct response and reinforcers becomes disproportionately large and can result in a reduction in correct responses. In some cases, responding may stop altogether. If either of these two undesirable results occur, it is best to return to providing reinforcers on a continuous basis, and then begin thinning again, this time in smaller steps.

Moving from continuous to intermittent reinforcement also gives the teacher the opportunity to start substituting reinforcers such as treats and trinkets with more natural reinforcers available in the learner's everyday environment. It is always best to utilize natural reinforcers whenever possible. In teaching a learner elementary play skills, a typical age-peer may be enlisted to provide reinforcement for responses such as imitating the way he or she stacks blocks, puts a puzzle together, pushes a toy car, or throws a ball. Interactions of this sort ordinarily are teeming with naturally occurring reinforcers. For a learner with autism, however, it is seldom the case that the natural environment, particularly the natural social environment, automatically takes on reinforcing properties. Careful monitoring is therefore required to determine whether or not the natural environment is able to maintain appropriate and desirable behavior.

Intertrial Interval

After a reinforcing consequence is either given for a correct response or withheld for an incorrect response, and after that consequence is either "consumed" or a brief period of time elapses in which the teacher ignores the learner for responding incorrectly, an ITI begins. It is important to keep the ITI distinct from the preceding and subsequent trials. This means that what happens during the ITI is unrelated to the previous instruction, the learner's response to it, and the consequence that followed the response. It also means that the ITI is unrelated to the next scheduled trial. It is usually best not to give an instruction during this time or to present or withhold a reinforcer. Instead, the teacher simply pauses during the ITI before he or she begins the next trial.

As a rule, the teacher should pause 3–5 s before beginning the next trial. Keeping the ITI this short has the advantage of maintaining the learner's attention to the teaching situation. A longer

ITI may invite undesirable responses such as fidgeting, whining, or crying and therefore should be avoided, especially in the early stages of teaching.

These, then, are the guidelines and the rationales for using them. As we said at the outset, the guidelines are basic, lean toward a how-to approach, are common to most teaching methods in ABA, and derive from a variety of sources in both the basic and applied branches of behavior analysis. (It bears repeating, too, that the reader should consult other sources for additional details on the finer points of the method.)

RECOMMENDED RESOURCES: A FINAL NOTE

As with all teaching methods, discrete trials constitutes a set of skills that can be construed as procedural knowledge in the sense that a teacher knows how to use the method with a learner. Knowing how to use a method seldom translates into knowing when to use it or what to teach with it. That knowledge is closely related to declarative knowledge in the sense that a teacher knows about a learner's skills and abilities and available teaching methods (and how to use them) in sufficient detail to make an informed decision about what should be taught and what method or combination of methods will lead to large and lasting gains for a given learner.

Deciding what to teach is an important matter that deserves far more attention than can be given to it here. Fortunately, several books are available that contain comprehensive curricula for young learners with autism, all of which are well suited to discrete trials teaching at home and in the classroom (e.g., Leaf & McEachin, 1999; Lovaas, 1971, 1981, 2003; Maurice, Green, & Foxx, 2001; Maurice, Green, & Luce, 1996; Partington & Sundberg, 1998; Simpson & Regan, 1988).

Deciding whether or not discrete trials is the best or most appropriate method for teaching a young learner with autism is also an important matter. One argument in favor of using the method with young learners with autism is based on the fact that they are notoriously difficult to teach. That is, they seldom display personally and socially desirable behaviors to which reinforcements can be applied (cf. Wolf et al., 1964), engaging instead in behaviors that interfere with teaching and learning. To discourage those behaviors while simultaneously encouraging appropriate and desirable behaviors, it is often necessary to create a highly contrived, tightly controlled, and carefully monitored teaching environment. The discrete trials method can be the centerpiece of this environment, particularly with young learners in the early stages of teaching basic skills and abilities such as attending, imitating, following instructions, and answering questions (Anderson, Taras, & Cannon, 1996; Fenske et al., 2001). Once the basic skills and abilities are well learned, other ABA methods such as incidental teaching (Fenske et al., 2001) can be introduced that extend and elaborate upon a learner's new skills and abilities in more natural learning environments.

A second argument in favor of using discrete trials teaching with young learners with autism is based on research showing how remarkably effective the method is with this population (e.g., Anderson, Avery, DiPietro, Edwards, & Christine, 1987; Birnbrauer & Leach, 1993; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Sheinkopf & Siegel, 1998). Cast in this light, ABA in general and discrete trials teaching in particular can contribute enormously to the education and treatment of learners with autism and can give them an unprecedented chance to lead an independent, productive, and happy life.

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