Chapter 3:

Principles of Applied Behavior Analysis to Teach

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Principles of Applied Behavior Analysis to Teach
Kristy Lee Park, George Mason University

The current chapter will present an overview of Applied Behavior Analysis (ABA) as an effective teaching method. ABA is an approach that, when used properly, can work to teach a wide range of behaviors to a wide range of participants. ABA is a research-based science, derived from the experimental analysis of behavior and the application of those procedures. Multiple studies demonstrate that people’s lives can be improved by learning academic skills (Gardner, Heward, & Grossi, 1994), social skills (Garcia-Albea, Reeve, Brothers, & Reeve, 2014) and communication (Luczynski & Hanley, 2013) and by the reduction of problematic behaviors (Roantree & Kennedy, 2012). The foundation of ABA rests on the analysis of environmental influences, such as what happens before and after a problematic behavior (antecedents and consequences) to predict when behaviors will increase, decrease, or remain the same. These principles of reinforcement and punishment will be summarized to highlight the main procedures that teachers may find effective in the classroom. Finally, this chapter will end with a case example that will walk through how a teacher applies the principles and procedures highlighted in this chapter.
Chapter objectives

1. Define Applied Behavior Analysis and explain the characteristics within a 5-step model
2. Describe the principles and procedures that increase or decrease behaviors
3. Provide an example of the application of ABA in the classroom

Defining Characteristics of Applied Behavior Analysis

Principles of ABA for Teachers Video,

https://www.youtube.com/edit?o=U&video_id=UuvQpat4CAk

Based on the principles of learning theory, Applied Behavior Analysis (ABA) is an applied science, meaning that practitioners use systematic procedures to teach, resulting in improvements in areas like self-care, communication, academics, behavior reductions, behavior, and/or recreation and leisure (Allen & Wallace, 2013; Van Camp &
Behavior analysts approach problems of social significance from a scientific perspective. It is not a matter of nature versus nurture but a matter of nature and nurture working together to produce observable changes in behavior (Skinner, 1974). This focus on social relevance, or social validity, to the individual marks a division in the field of behaviorism from a strictly experimental or basic research to an applied research. Baer, Wolfe, and Risley (1968) clarified this distinction in the seminal article “Some Current Dimensions of Applied Behavior Analysis,” published in the first issue of the *Journal of Applied Behavior Analysis*, which describes ABA and outlines the future applications of its characteristics. These seven characteristics include: applied, behavioral, analytic, conceptual, technological, effective, and generalizable. When using ABA, one incorporates these components within a process to teach and evaluate effects of the approach. For example, one starts with 1) choosing a socially relevant behavior, 2) measuring the behavior, 3) using data to determine which treatment to use, 4) using data to implement procedures, and 5) using data to evaluate effects of the treatment (Cooper, Heron, & Heward, 2007).

The characteristics of ABA will be described within this 5-step model to show how the fundamental characteristics are interwoven with data to make a good ABA program.

**Select a Socially Relevant Behavior**

ABA is *applied*, meaning that the targeted behavior is of social importance to the individual, rather than its importance to theory (Baer et al., 1968). The proposed behavior change is meaningful to the client and all those who may be affected by the intervention (i.e., parents, siblings, staff). For each targeted problematic behavior, a desired behavior is also identified, optimally a behavior that is incompatible with the
problematic behavior. A common problem is that teachers have too many behaviors identified for change. Cooper et al. (2007) provide guidance on the selection process through guiding questions that help teachers set priorities or criteria for choosing one behavior over another. These include:

1. Does the behavior pose a danger to the student or others?
2. Does changing the behavior improve the person’s life and is this behavior change age-appropriate?
3. What is the likelihood of success to change this behavior? For example, are there sufficient opportunities to show the behavior in the natural environment (i.e., classroom) and will teachers and staff reinforce this behavior when demonstrated?
4. Will changing the behavior have long-standing effects or lead to further skill development?
5. Do the benefits of teaching this behavior outweigh the costs (i.e., time, resources) needed?

These guiding questions assess the behavior of interest based on safety concerns, probability of intervention fidelity by the staff who may be involved, and risk-benefit analysis of the proposed behavior. Social relevance or applicability is therefore worked into proposed short- and long-term goals, teaching procedures, and potential results to increase maintenance and generalization of the skill use (Wolf, 1978). Examples can include social skills to increase peer interactions, fluency of academic skills, decrease of maladaptive behaviors that interfere with successful interactions with peers and
staff, self-help skills to build independence, or leisure and recreational skills to improve quality of life.

**Measure the Behavior with a Reliable Data Collection System**

*Behavioral* means that the behavior itself is the subject matter, so the dependent variable must be operationalized in observable and measurable terms with the goal of having inter-observer reliability, or a high percentage of agreement between multiple observers that the same behavior occurred or did not occur during observations. In order for direct observations to occur, there must be a precise definition of the behavior and a measurement system to record the behavior. Choosing a measurement system depends on how the behavior is exhibited (Alberto & Troutman, 2003). For example, the behavior may be problematic because of how often it occurs (i.e., too many times or not enough times) or the length of the response (i.e., too short or too long). When the number of occurrences of the behavior is the problem, one would choose an event-recording system if the behavior has a specific start and end in order to teach occurrence, like the number of times a student talks out of turn during instruction time. If the response does not have a distinct beginning and end, use an interval recording system. When the length of time the behavior occurs is the problem, choose duration recording to measure the span of each occurrence. Like duration, latency measures time; however in this measurement, one measures the elapsed time after a signal and the onset of the behavior. For example, one could measure the amount of elapsed time between when the teacher gives the direction and when the student starts the first problem.
The context in which the behavior is exhibited provides a picture of when the behavior occurs or does not occur in relation to other events (Johnston & Pennypacker, 1993). Observing the changes of behavior requires knowledge of an analytic approach. To be analytic requires a believable demonstration of the events that caused the change in behavior. These changes of behavior are empirical demonstrations of functional relations between antecedent events, behavior, and consequence events. There are different degrees to this level of analytic behavior change. At the highest level, research methodology using single-subject research designs (i.e., reversal, multiple-baseline line) is used to determine if functional control is established, verified, and replicated (Kennedy, 2005). A less-rigorous level still includes demonstrations of prediction and control (i.e., baseline or phase with no intervention, intervention phase, intervention removal, and reintroduction of the intervention) but may have lower levels of inter-observer reliability of data-collection procedures. The value of the data depends on the accuracy and reliability of the data to make decision about which intervention to choose, continuation of the procedures, or when to stop the intervention.

Select Evidence-Based Treatment Procedures Based on Behavior Contingencies

Conceptually systematic highlights ABA’s reference to the principles and basic concepts of behavioral development (Baer et al., 1968). Predicting why the behavior change occurred relies on the established principles in behavior analysis and the past repertoires of the individual.

One observes the patterns or relationships (i.e., contingency) between stimuli before and after behavioral responses. An example of the contingency between the
antecedent and behavior is provided in the following if-then contingency statements: The behavior happens only when the antecedent has happened first, and if the antecedent doesn’t happen, the behavior doesn’t happen. If the antecedent happens, the behavior happens as well. The behavior doesn’t happen unless and until the antecedent has happened first. The repeated and predictable patterns between the antecedent and/or consequent stimuli and the behavior are described as functional relations. The function of behavior refers to the effect the behavior produces on the environment and behavior serves two major functions: to obtain desired events (i.e., objects, attention) or to avoid/escape events (i.e., work, interaction with others). For example, a student may cry as a function to get the desired object but the same behavior for another student may use crying to escape work demands. This is why ABA focuses on the context and contingencies for each student rather than a topography-based intervention, in which all students who engage in the same behavior get the same type of intervention. Interventions focus directly on environmental events that generate and maintain behavior. It’s the antecedents that get the behavior moving but the consequences that keep the behavior going (Daniels, 2000); therefore, ABA interventions arrange contingencies of reinforcement to alter the problematic behavior to make the alternate behavior more effective, efficient, and relevant for the student (Sugai & Horner, 2006).

ABA makes interventions specific to the individual, based on the function the behavior may serve for the person. These can be broadly categorized as function-based (negative or positive reinforcement) and include antecedent-based (i.e., prompts, choice, environmental arrangements) and consequence-based procedures
(i.e., positive punishment, token economy, response-cost, differential reinforcement procedures). Antecedent technologies such as modeling, prompting, and prompt-fading are often used to teach new behaviors, or shape new behaviors by reinforcing successive approximations (Alberto & Troutman, 2003). Importantly, larger or more complex skills are broken into component skills (i.e., task analysis) and skills are taught in a specific teaching sequence (i.e., forward chaining, backward, total-task). Instructional procedures like discrete trial training (DTT) or errorless learning have also broken skills into teachable steps then presented in trials, or multiple opportunities, until performance meets a criterion level.

**Implement Procedures with Fidelity**

*Effectiveness* is the degree of learning, or the amount of change in student performance, in other words, the change of behavior (either increase or decrease) from baseline to after the intervention is implemented. Effectiveness looks at student performance data to modify what is taught (i.e., programs or curricula) as well as how it is taught. Data, especially data graphed visually, help teachers make decisions to keep going, revise, or stop an intervention. When student performance is not being made, contingencies surrounding the learning environment are examined and these include monitoring and modifying staff behavior.

Reliability measures and inter-observer agreement data collection provides an objective look at the consistency of how staff are recording behavior and also how staff are implementing the programs. A major component of staff performance is *technological*, a term that describes the clarity and precision of written procedures so that others can replicate the teaching. The success of interventions is largely
dependent on the extent to which they are implemented as designed with accuracy and consistency (i.e., treatment integrity; Gresham, 1989). To help with consistency, procedures are operationalized into step-by-step actions with visual prompts that prompt accurate staff behaviors (Noell et al., 2002). Performance feedback is another valuable tool for helping staff improve performance in the implementation of intervention plans (Codding, Livanis, Pace, & Vaca, 2008). In fact, research shows that when staff implement procedures with high fidelity, rates of problematic behavior are low, and the inverse is also shown—when there is low treatment fidelity, there is an increase in problematic behavior (Fryling, Wallace, & Yassine, 2012; St. Peter Pipkin, Vollmer, & Sloman, 2010).

**Evaluate Long-term Effects of Treatment**

ABA is committed to teaching skills that are practical, relevant, and functional for the student. The last ABA characteristic is *generality*, which describes whether interventions produce lasting change in behavior that occurs in all relevant settings. A student has truly learned the skill when the behavior is shown after a period of time (e.g., 6 months), untaught scenarios, and novel responses to similar antecedents (Baer, 1982). This happens when practitioners incorporate generalization strategies into teaching procedures through multiple teaching examples, practice opportunities outside of the teaching setting, and, importantly, teach the students how to recruit reinforcement (i.e., teacher attention) through socially acceptable behaviors (Reeve, Reeve, Townsend, & Poulson, 2007). Incidental teaching has been used to promote generalization of language skills (Hart & Risley, 1968), social interactions (Strain, 1983), and reciprocal interactions with peer models (McGee, Almeida, & Sulzer-Azaroff, 1992).
This teaching procedure occurs in the naturalistic context and consists of a prescribed chain of student-teacher (or peer-sibling) interactions in which the student initiates a request (e.g., reaching, pointing, vocalizing) and the item requested is given contingent upon appropriate asking in the targeted mode.

In this section, the characteristics of applied behavior analysis were described within a model that all ABA-based approaches have in common which are: 1) select a socially relevant behavior, 2) measure the behavior with a reliable data collection system, 3) select an evidence-based treatment procedure, 4) implement the procedures with fidelity, and 5) evaluate the long-term effects of the treatment.

**Procedures**

This chapter has discussed how student behavior is regulated by consequences, which are the events that occur after the behavior. The description and analysis of these contingencies surrounding a behavior is operant conditioning, which describes the probability of certain behaviors based on the history of consequences (Skinner, 1974). Reinforcement and punishment are the core tools of operant conditioning, and both affect the desired behavior: reinforcement increases and punishment decreases the probability of the desired behavior. Events can be added in (positive) or removed (negative) from reinforcement and punishment procedures. For example, positive reinforcement is the addition of a stimulus (i.e. praise, token), whereas negative reinforcement is the removal of a stimulus (i.e., loud noise, work demand), and both maintain or increase the frequency of the behavior.
Procedures to Increase Behaviors

In negative reinforcement, a stimulus is present, and the occurrence of the targeted behavior removes the stimulus (Cooper et al., 2007). For example, a difficult task is presented, the student asks the teacher for help, the difficult task is removed, and over time the frequency of the student asking the teacher for help increases. With positive reinforcement, when the targeted behavior occurs, something is added to the environment, and that behavior is more likely to occur in the future. What often gets added is called reinforcers and the types of reinforcers include unconditioned reinforcers (i.e., food, drink) and conditioned reinforcers (i.e., edible, sensory, tangible, activity, social; Cooper et al., 2007). Reinforcers have different values for different individuals; therefore, reinforcer assessments are conducted to identify potential reinforcers. This is done by asking the student, asking others who know the student well, observing the student, or using trial-based methods (i.e., single, paired, multiple; Carr, Nicolson, & Higbee, 2000).

Along with the potential value of reinforcers to the student, other factors related to effectiveness include when it is provided (i.e., immediacy), the level of effort required to perform the behavior and the likelihood of the delivery of the reinforcer (i.e., response effort), availability of the reinforcer elsewhere, and motivational effect (i.e., how much does the student want it based on the state of deprivation or satiation; Michael, 2000). Reinforcers can be provided on a continuous or an intermittent schedule, immediately after the behavior or after a delay, and the decision to use one schedule of reinforcement or another can have predictable effects on the consistency of performance and rate of response. This determines when the reinforcer is
provided—immediately or after a delay (i.e., interval schedule) or after a specific number of responses (i.e., ratio schedule). For example, when a student is learning addition facts, the teacher may provide continuous reinforcement (after every response) to get the quickest learning rate, then fade the schedule to reinforcement after every third response (fixed ratio 3) based on student response.

**Decreasing Unwanted Behavior**

Like reinforcement, punishment is defined by its effect, by adding (i.e., positive) or removing (i.e., negative) something in the environment, to decrease the future probability of the behavior. The problem with punishment procedures in itself is that they don’t teach what to do instead of the punished behavior, but only provide temporary decrease with unintended potential side effects (Rolider, A., Cummings, A., & Van Houten, R. 1991). Extinction decreases behavior by discontinuing the reinforcement after a behavior and is used in conjunction with reinforcement such as differential reinforcement procedures (i.e., alternative, incompatible, other).

**Example from the Classroom**

In the kindergarten classroom during center time, Ms. Kang ran over to the train set to stop Alex from bothering a classmate again. After being put in time out, Alex returned to the train center and initiated play by shoving a train track into the classmate’s hand. Then he grabbed a train from another peer. Alex was a bright student, verbal and compliant to teacher requests; however, his behaviors during peer play restricted interactions. Ms. Kang and Alex’s mother agreed that teaching Alex to play would help reduce aggressive behaviors and facilitate social interactions with others. For step 1, select a socially relevant behavior, aggression was operationalized
as unsolicited physical contact with peers (i.e., pushing, pulling, and/or forceful grabbing, excluding tripping or falling onto peers). The long-term desired behavior was to ask, wait, and accept the answer “no”; however, the short-term behavior included appropriate peer social interactions using skills such as getting a peer’s attention, asking peers to play, and sharing objects for one minute.

For step 2, measure the behavior, an event-recording data sheet was used during the most problematic routine, center time. Appropriate peer interactions were task analyzed into teachable steps and measured as the number of correct steps completed (see Appendix). Ms. Kang and the instructional assistant, Ms. Sanchez, used the operational definition and data-collection sheet to observe so that they both agreed that the behavior was measured accurately. Next, both observed the social interactions of four boys during the train center time using an antecedent-behavior-consequence data sheet to identify predictable hypotheses such as, when the train track is started by others, Alex will engage in aggression to obtain items (i.e., remove the tracks), to start another track he designed. A reinforcer assessment indicated trains as the highest reinforcer and the absence of a train track at home strengthened the value of this reinforcer.

The next step was to select an evidence-based treatment. A differential reinforcement of alternative (DRA) procedure was used to decrease aggressive behaviors through extinction (i.e., aggressive behavior no longer resulted in access to item) and appropriate social interactions was reinforced with access to trains. The task analysis of peer play with trains was directly taught. The ten steps were printed and cut out so that Alex could sequence the steps. He then watched a teacher and then
peer model each step. A backward chaining instructional model was used so that the teacher prompted the first nine steps and Alex completed the last step independently. This continued until he mastered all ten steps.

In addition, the entire class was taught what respecting property and others looked like during center time and the rules were reviewed before center times. To neutralize the antecedent, each center activity was postponed until all peers were in the group. The absence of aggressive behaviors (i.e., one-minute intervals) resulted in a train sticker and the accumulation of train stickers allowed additional time in the train centers.

To measure implementation with fidelity, Ms. Kang and Ms. Sanchez agreed to both take data for one session during five sessions available using the data sheets located in the same secured location. The staff teaching steps were laminated and both teachers reviewed the steps and the data during Thursday morning planning times. Prior to baseline, the average number of aggressive occurrences was seven, and afterward, when peer skills were directly taught through a DRA procedure, the number of aggressive occurrences was zero. During baseline, the correct number of steps completed was 10%, and after instruction, Alex maintained 80% or higher for five consecutive days.

Last, the ABA program was evaluated for effectiveness and generalization. Based on the data, Ms. Kang continued with the DRA intervention and focused on generalization of peer skills to other center areas. A checklist of the peer-interactions task analysis was sent as homework for Alex’s mother to work on with Alex and his other peers.
Summary

This chapter focused on applied behavior analysis (ABA), the definition, the characteristics, and the procedures that make this a program that works to teach desired behaviors. Teachers can design and implement an ABA program using a 5-step model to:

1) Select a socially relevant behavior
2) Measure the behavior using reliable data-collection measures
3) Select an evidence-based treatment based on the contingencies of the behavior
4) Implement procedures with fidelity
5) Evaluate long-term effects
References


Appendix A: Measure Behavior

Event Recording Sheet

Instructions
Tally each occurrence of the behavior. Place completed sheet into the data collection binder in the locked drawer. This data will be graphed on Thursday by Ms. Kang.

Student: ________________ Date: _______ Time (Start): _________ Time (End): _______

☐ Baseline ☐ Intervention
Behavior: ________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Context/Activity (e.g. time during the activity, number of students, behaviors of the students)
________________________________________________________________________
________________________________________________________________________

Tally each occurrence:

<table>
<thead>
<tr>
<th>Total:</th>
<th>Rate:</th>
<th>per minute</th>
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</thead>
<tbody>
<tr>
<td></td>
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</table>
Student: ____________________  Target Skill: Play Activity with Trains

Prompt: “Time for trains”

Describe each step, in order, for the behavior. Then, for each date on which the behavior is practiced, record the level of independence for each step of the behavior. Use the following symbols for your records:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Independent, Correct</td>
</tr>
<tr>
<td>V</td>
<td>Verbally Prompted</td>
</tr>
<tr>
<td>M</td>
<td>Modeled, Gesture</td>
</tr>
<tr>
<td>P</td>
<td>Physically Prompted</td>
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</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Description of Step</th>
<th>Date:</th>
<th>Date:</th>
<th>Date:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>1.</td>
<td>Asks peer to play</td>
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<tr>
<td>2.</td>
<td>Tells peer, “Let’s play trains”</td>
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<tr>
<td>3.</td>
<td>Gives peer at least two tracks</td>
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<tr>
<td>4.</td>
<td>Tells peer, “Let’s make a train”</td>
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<tr>
<td>5.</td>
<td>Asks peer for train pieces</td>
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<td></td>
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<tr>
<td>6.</td>
<td>Puts train pieces together with peer’s pieces</td>
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<td></td>
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</tr>
<tr>
<td>7.</td>
<td>Asks peer for animals to put on train</td>
<td></td>
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<tr>
<td>8.</td>
<td>Moves train around track</td>
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<tr>
<td>9.</td>
<td>Tells peer, “Your turn!”</td>
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</tr>
<tr>
<td>10.</td>
<td>Tells peer, “That was fun!”</td>
<td></td>
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</tbody>
</table>