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Applied behavioral analysis (ABA) techniques for pediatric occupational therapists: Applications to motor learning

Brittany N. Hand, PhD, OTR/L

Objectives

At the end of this course, you will be able to:

1. Recognize common ABA terminology
2. Identify an appropriate ABA technique given an occupational therapy treatment scenario
3. Identify how to utilize ABA principles in motor learning interventions
Agenda

- Introduction to ABA
- Types of practice and activity selection
- Feedback and reinforcement mechanisms
- Shaping, cuing, and prompting
- Applications to intervention planning
- Summary
- Q & A
Introduction to ABA

- Motor learning:
  - The process of acquiring a skill by which the learner, through practice and assimilation, refines and makes automatic the desired movement.
  - An internal neurologic process that results in the ability to produce a new motor task.
  
  (Medical Dictionary for the Health Professions and Nursing, 2012)

Introduction to ABA

- Applied behavior analysis (ABA):
  “A scientific approach for discovering environmental variables that reliably influence socially significant behavior and for developing a technology of behavior change that takes practical advantages of those discoveries”
  
  (Cooper, Heron, & Heward, 2007)
Introduction to ABA

- Predicated on operant conditioning

Antecedent → Behavior → Consequence

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Introduction to ABA

- Knowledge check

Antecedent → Behavior → Consequence

- A therapist designs a treatment activity to have a child place blocks into a container to work on active release. The therapist places the container in front of the child. The child places the block in the container. The therapist provides verbal praise.
  - What is the antecedent?
  - What is the behavior?
  - What is the consequence?
Agenda

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Types of practice and activity selection

**Massed Practice**
- Better for children
  (DeLuca, Echols & Ramey, 2007; Sterr et al., 2002)

**Distributed Practice**
- Better for adults
  (Krakauer, 2006)
Types of practice and activity selection

Constant Practice

Variable Practice
- Leads to better retention (Kantak et al., 2010)

- Purposeful activity vs. rote exercise
Types of practice and activity selection

- Knowledge check
  1. Working on one 10-minute visual motor task during each weekly therapy session over 1 month
  a) Massed
  b) Distributed
  c) Variable
  d) Constant
  2. Tying shoes is the only treatment activity
  3. Treatment alternates between tying shoes and working on other underlying skills with other play-based games
  4. Working on visual motor coordination tasks for 3 hours

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- Introduction to ABA
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Feedback and reinforcement mechanisms

- Feedback: Knowledge of performance

You reached so high!

Good holding your pencil with three fingers!

Feedback and reinforcement mechanisms

- Feedback: Knowledge of results

You hit the target!

Good getting the ball in the hoop!
Feedback and reinforcement mechanisms

- Reinforcement

Feedback and reinforcement mechanisms

- Reinforcement: Effectiveness
  - Factors that affect reinforcement (Cooper et al., 2007)
    - Size/amount/magnitude
    - Presented contingently
    - Immediacy
Feedback and reinforcement mechanisms

- Reinforcement: Schedules

  - Reinforcement Schedules
    - Continuous
    - Intermittent

  - Fixed Ratio
  - Fixed Interval
  - Variable Ratio
  - Variable Interval
Feedback and reinforcement mechanisms

- Reinforcement: Schedules
  - Intermittent schedules: Thinning

<table>
<thead>
<tr>
<th>Assess</th>
<th>Set</th>
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<tr>
<td>• Assess current performance level</td>
<td>• Requirements close to performance level</td>
<td>• Guided by the child’s performance</td>
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<td></td>
<td>• Schedule-change criterion</td>
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Feedback and reinforcement mechanisms

- Knowledge Check
  - Scenario: You are working with a child on pincer grasp. You set up a task where the child needs to pinch a clothespin to open it wide enough for it to fit onto a rod, and place it on the rod. On the first attempt, the child fails to pinch hard enough, and drops the clothespin. On the second attempt, the child successfully completes the task.
    - Provide an example of knowledge of performance
    - Provide an example of knowledge of results
Agenda

- Introduction to ABA
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- **Shaping, cuing, and prompting**
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Shaping, cuing, and prompting

- **Shaping:** The process of differentially reinforcing successive approximations to a desired behavior (Cooper et al., 2007)
- A desired behavior is a predetermined level of performance and can be based on:
  - The way the movement looks
  - Frequency of movement
  - Duration of movement/task
Shaping, cuing, and prompting

- **Shaping**: The process of differentially reinforcing successive approximations to a desired behavior (Cooper et al., 2007)
- **Differential reinforcement**:
  - Reinforcement is provided for responses that share a predetermined dimension or quality
  - Reinforcement is withheld for responses that do not demonstrate that quality

- **Successive approximations**
  - Movements that emerge during the shaping process as the result of differential reinforcement
  - Each successive approximation is closer in form to the desired behavior than the movement that preceded it
Shaping, cuing, and prompting

- Shaping: Example
  - A therapist is working with a child to develop a tripod grasp. The child currently uses a palmar supinated grasp for all tasks with writing utensils.
  - The therapist trained fisted palmar grasp: already in repertoire

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Shaping, cuing, and prompting

- Shaping: Example

  ![Diagram]

  - Antecedent: Presentation of the crayon
  - Behavior: Palmar grasp of crayon
  - Consequence: Child is given paper to color

  ![Diagram]

  - Antecedent: Presentation of the crayon
  - Behavior: Digital grasp
  - Consequence: Receiving the paper
  - Behavior: Palmar grasp of crayon
  - Consequence: The paper withheld
Shaping, cuing, and prompting

- Shaping: Example

[Diagram showing antecedent, behavior, and consequence for shaping example]
Shaping, cuing, and prompting

- Shaping: Example

<table>
<thead>
<tr>
<th>Initial Behavior</th>
<th>Intermediate Behavior</th>
<th>Intermediate Behavior</th>
<th>Terminal Behavior</th>
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<tbody>
<tr>
<td>Palmar grasp</td>
<td>Digital grasp</td>
<td>Quadrupod grasp</td>
<td>Tripod grasp</td>
</tr>
</tbody>
</table>

Time

- Shaping different dimensions of movement
  - Topography: form of behavior (what it looks like)
  - Frequency: number of instances per unit of time
  - Duration: length of time the movement occurs
Shaping, cuing, and prompting

- Cues and prompts
  - Supplementary stimuli used to elicit the target behavior
    - (Stimulus) Cues:
      - Movement cues: pointing, tapping, touching or looking at the correct response item to provide a cue as to the action wanted
      - Position cues: placing one stimulus closer to the child
    - (Response) Prompts:
      - Verbal instructions: includes spoken and written language
      - Modeling: demonstrating desired behavior you want the child to perform
      - Physical guidance: partial physical guidance of the child’s movements (hand over hand)

Shaping, cuing, and prompting

- Cues and prompts: Fading
  - Most-to-least
    - Physically guide child
    - Gradually reduce the amount of physical assistance
    - Provide a model
    - Provide verbal instruction
    - Present task with no prompts
Shaping, cuing, and prompting

- Knowledge check
  1. Tapping on the block that you’ve asked the child to grasp
  2. Providing hand-over-hand assistance to pick up the block
  3. Teaching a child to use digital grasp to pick up a block by providing reinforcement when they do, and withholding reinforcement when they use palmar grasp

- Prompt
- Shaping
- Cue

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- Introduction to ABA
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Applications to intervention planning

- A therapist is trying to get a child to toss a ball into a basket. The therapist says “Put the ball in,” but the child does not attempt to complete the task. Assume that this activity is the appropriate “just right challenge” for the child. What next step should the therapist take?
  - a) Discontinue the activity and switch to something easier
  - b) Provide a prompt such as modeling the activity
  - c) Tell the child he will not earn his desired reward (e.g., swinging) if he does not complete the task
  - d) Bribe the child by promising him that he can play outside after putting the ball in the basket.

Applications to intervention planning

- A therapist is trying to get a child to use active release to drop a block into a bucket. The child drops the block into the bucket by shaking his hand to free the block instead of active release. Assume that this activity is the appropriate “just right challenge” for the child. What next step should the therapist take?
  - a) Give positive reinforcement since the child achieved the goal
  - b) Withhold reinforcement and feedback and ask the child to try again
  - c) Praise the child for their effort, and provide knowledge of performance, “Next time, let’s throw it like this [demonstration].”
  - d) Discontinue the activity and switch to another task to elicit the desired movement.
Applications to intervention planning

A therapist is working with a child on a shoulder strengthening task. Each time the child successfully completes the task, the therapist gives him verbal praise. During one trial, the child exceeds the therapist’s expectations by performing better than he has in any other trial. To increase the likelihood of the child repeating that movement/behavior in the future, the therapist should:

a) Give the child verbal praise, like they have for all other trials
b) Increase the magnitude of the reinforcement by, for example, singing a preferred song
c) Withhold reinforcement
d) Switch to a different activity

Applications to intervention planning

Trevor

Trevor is a 6 year old male with Down syndrome and autism who presents with hypotonicity and poor strength of BUE. He attends an alternative school which uses a behavioral approach to education. Trevor is non-verbal and has an intellectual disability, but demonstrates success with stimulus-response-reward tasks. The therapist wants Trevor to increase his index finger isolation as a precursor skill for buttoning and shoe tying (long-term goal). The short-term goal is for him to use an isolated index finger when he plays developmentally appropriate games on the iPad. Trevor currently plays on the iPad with all fingers in extension. How could you use motor learning to help Trevor meet this goal?
Applications to intervention planning

- Mohamed

Mohamed is a 7 year old male with specific learning disability. He receives OT services at school as part of his IEP. Mohamed struggles with handwriting legibility due to problems with letter formation. Mohamed has come a long way this school year, but still struggles with writing letter “r.” You would like to teach Mohamed how to correctly form letter “r” to increase his handwriting legibility. How could you use motor learning principles to do this?

The little girl is riding the bus.
The bus is red. The bus came to her home.

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- Introduction to ABA
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Summary

1. Define common ABA terminology
   - Operant conditioning
   - Massed, distributed, variable, and constant practice
   - Knowledge of performance, knowledge of results
   - Reinforcement
   - Schedules of reinforcement
   - Shaping
   - Cuing, prompting

2. Identify an appropriate ABA technique given an occupational therapy treatment scenario
   - Multiple choice questions

3. Explain how to utilize ABA principles in motor learning interventions
   - Case studies

Agenda

- Introduction to ABA
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- Q & A
Questions?

- Contact me at: handbr@musc.edu

References

Resources

- Learning to headstand (2:33-5:35)

Case Study

- Clara
  - You are working with Clara, a preschooler, to increase visual motor coordination to color within the lines. Clara is able to stay inside the lines about 15% of the time.
    - Provide an example of how you could use knowledge of performance and knowledge of results in this context
Case Study

- Annie
  - You are working with Annie, 5 year old with hemiplegic CP, to increase bilateral coordination. The treatment activity is cutting with scissors. Currently, Annie uses her affected upper extremity for paper manipulation with maximal assistance and verbal cues. How could you use shaping to increase Annie’s independence in this task?
    - What should you reinforce?
    - How often do you reinforce?