Update on Research on Verbal Behavior and Autism

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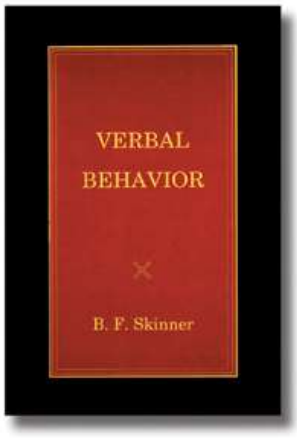
Purpose: To summarize and synthesize recently published findings on teaching verbal behavior to individuals with ASD.

- The goal is for you to become aware of recent studies that may be relevant to what you do in your practice.
- You won't get all the information you need to implement the procedures, but you will know where to find articles that may be useful to you.

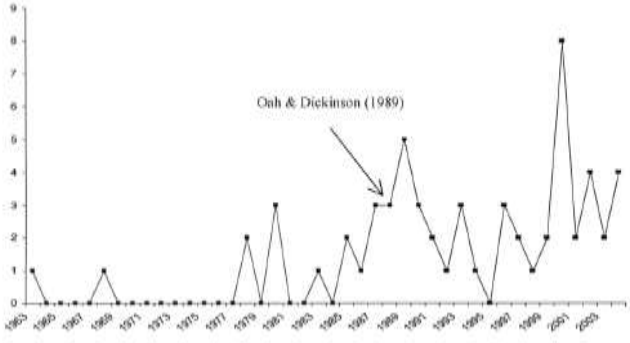
B. F. Skinner's (1957) analysis of verbal behavior will be used as a framework for classification and discussion

Mands, tacts, intraverbals, echoics, etc.



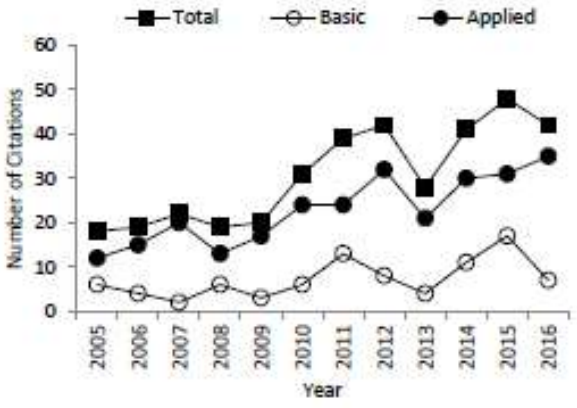
VB Research: Recent Developments

Sautter & LeBlanc (2006): Empirical research on Skinner's verbal operants



VB Research: Recent Developments

Petursdottir & Devine (under review): Empirical research on Skinner's verbal operants 2005-2016



VB Research: Recent Developments

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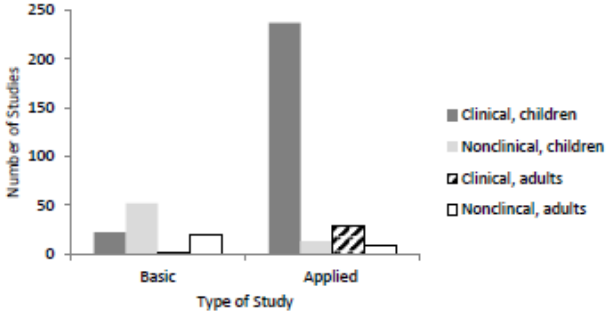

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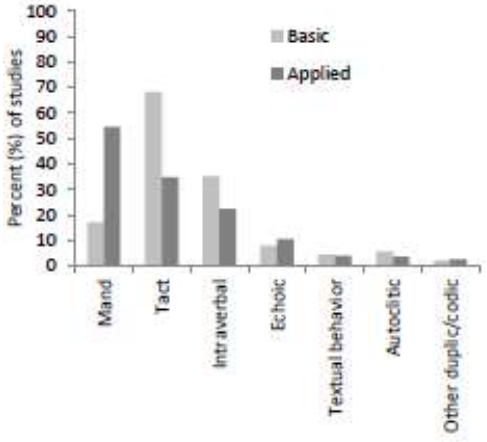

Studies Included in Present Review

Empirical studies on teaching verbal behavior to children with autism spectrum disorder published from July 2015 through June 2017

How identified:

- Database from Petursdottir & Devine (under review)
- PsycINFO search for 2017 using verbal operant search terms
- PsycINFO search using other keywords related to commonly addressed topics in studies already identified

Excluded:

- Studies in which no participants had ASD diagnoses
- Studies in which the primary focus was reduction of problem behavior
- Studies in which the primary focus was on staff training
- Studies that focused on listener behavior exclusively
- Studies that focused on textual behavior exclusively
- Studies published in languages other than English
- Studies for which full text could not be accessed

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

1. Establishing functional vocalizations and improving echoic repertoires (3)
2. Selecting appropriate mand modality (5)
3. Establishing mands for preferred items (6)
4. Promoting variability in the form of manding (5)
5. Decreasing high rates of manding (3)
6. Teaching mands for information (4)
7. Procedural variables in tact and intraverbal instruction (8)
8. Establishing complex stimulus control over intraverbals and tacts (7)
9. Emergence of untaught intraverbals and tacts (7)
10. Using instructive feedback to expand verbal repertoires (5)
11. Teaching conversation skills (4)
12. The PEAK® curriculum (14)

*One article counted twice because two experiments addressed different themes

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Increasing Vocalizations and Establishing Echoic Repertoires

How can we promote vocal development and establish echoic responding in children who do not have vocal echoic repertoires or any vocal communication?

- Differential reinforcement and shaping of vocalizations (e.g., Lovaas, Berberich, Perloff, & Schaeffer, 1966; see also Lovaas, 2003)
- Stimulus-stimulus pairing to induce novel types of vocalizations (e.g., Esch, Carr, & Grow, 2009)
- Lag reinforcement schedules to increase variability of vocalizations (Koehler-Platten, Grow, Schulze, & Bertoni, 2014)
- Teaching manding (and other verbal behavior) using an augmentative or alternative (AAC) communication system (e.g., Tincani, Crozier, & Alazetta, 2006)

Recent research on establishing functional vocalizations and improving echoic repertoires

New studies on establishing functional vocalizations and improving echoic repertoires:

Choi, J., Greer, R. D., & Keohane, D. (2015). The effects of an auditory match-to-sample procedure on listener literacy and echoic responses. *Behavioral Development Bulletin, 20*(2), 186-206. doi:10.1037/h0101313

Cividini-Motta, C., Scharrer, N., & Ahearn, W. H. (2017). An assessment of three procedures to teach echoic responding. *The Analysis of Verbal Behavior, 33*(1), 41-63. doi:10.1007/s40616-016-0069-z

Gewarter, C., O'Reilly, M. F., Kuhn, M., Mills, K., Ferguson, R., & Watkins, L. (2016). Increasing the vocalizations of individuals with autism during intervention with a speech-generating device. *Journal of Applied Behavior Analysis*, 49, 17-33.

Gewarter et al. (2016)

Several studies have shown increases in vocalizations when children begin to use AAC systems

- PECS (e.g., Charlop-Christy et al., 2002; Ganz & Simpson, 2004; Greenberg, Tomaino, & Charlop, 2014; Tincani et al., 2006)
- Speech-generating devices (SDGs; Roche et al., 2014; Sigafoos et al., 2011)

Participants in this study were four boys (4-7 years) diagnosed with severe ASD who did not communicate vocally and had minimal echoic repertoires; all had prior experience using SDGs to mand for preferred items.

Could differential reinforcement increase vocalizations alongside or in place of SDG mands?

Gewarter et al. (2016)

Application: GoTalk Now on iPad or iPad Mini

- Screen had one large button with photograph of preferred item (one item for each child)

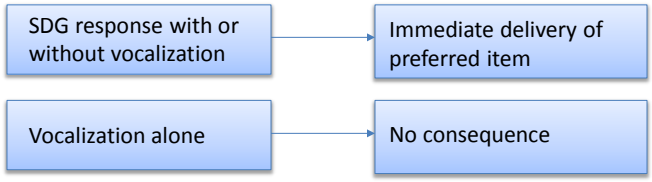
Independent vocalization: Target vocalization emitted without therapist prompt during an instructional trial

Vocal initiation: Independent target vocalizations that occurred before the SDG speech output

- Potential mands

Gewarter et al. (2016)

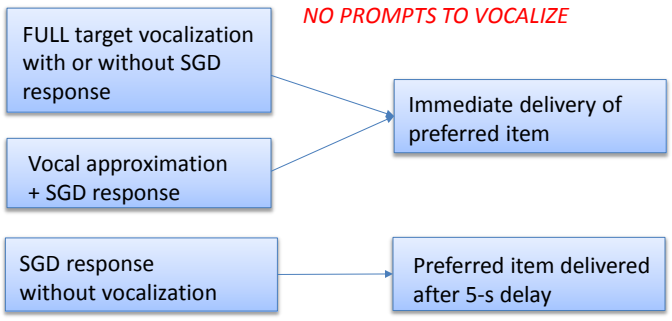
Baseline:



No vocalizations or low levels of vocalizing

Gewarter et al. (2016)

Phase 1:



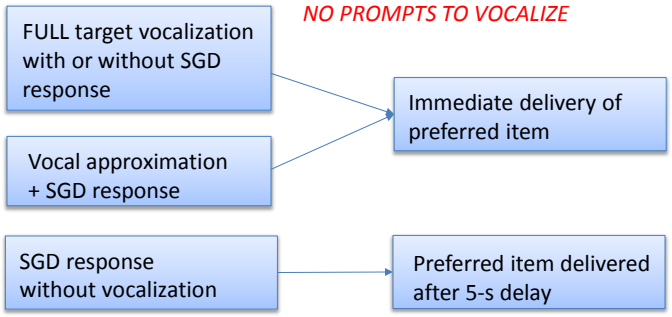
Two participants' independent vocalizations increased to mastery and vocal initiation began

- Approximations only

Two participants' vocalizations did not increase from baseline

Gewarter et al. (2016)

Phase 1:



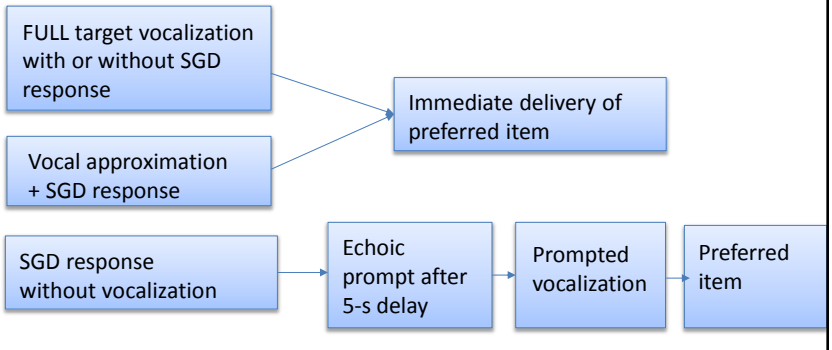
Two participants' independent vocalizations increased to mastery and vocal initiation began

- Approximations only

Two participants' vocalizations did not increase from baseline

Gewarter et al. (2016)

Phase 2 (remaining two participants):



One participant's independent vocalizations increased to high levels that were maintained after prompts were withdrawn in a return to Phase 1, and vocal initiation began

The other participant's independent vocalizations remained at low levels and there were no vocal initiations, but he made many prompted vocalizations in Phase 2 and articulation improved

Gewarter et al. (2016)

The vocal initiations (3 of 4 participants) occurred in a minority of trials but occurred reliably

- Also in generalization probes conducted without the SDG
- Potential mands, although EO control was not verified

In conclusion, the SDG did not automatically increase vocalizations (baseline), but it did so when a reinforcement contingency was placed on vocalizations

- Pairing of preferred item with its name contingent on SGD response (baseline) was not sufficient to increase vocalizations
- Response-contingent stimulus-stimulus pairing (Lepper & Petursdottir, accepted)

No prompting or vocal modeling by a therapist required for two participants

Other Studies

Cividini-Motta et al (2017): Compared the effects of three teaching procedures on echoic responding

- Vocal imitation training (differential reinforcement of echoic responses)
- Mand-model ("What do you want?" + prompt delay + differential reinforcement of echoic or independent vocalizations appropriate to a particular reinforcer)
- Stimulus-stimulus pairing (therapist vocalizations paired with delivery of preferred items; no response requirement and echoic control not addressed directly)

Five of six participants began to vocalize some or all target sounds during teaching sessions and showed evidence of echoic control

Most effective procedure varied across participants and all three were equally often identified as "best."

Other Studies

Choi et al. (2015):

- Participants in this study (two experiments) communicated vocally but echoic repertoires were "inexact"
- Auditory matching-to-sample protocol (1) listen to a sample auditory stimulus, (2) listen to two auditory comparisons, (3) pick the comparison that matches the sample
  - Complexity increased across phases from single words (e.g., "plate" vs. "eight") to short phrases (e.g., "my best friend" vs. "your best friend") to long, uncommon words (e.g., "thermoplastic")
- Accuracy of echoic responses (common words, foreign words, long and uncommon words) improved for all participants
  - As did responses to spoken instructions presented with visual distractors

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Selecting Mand Modality

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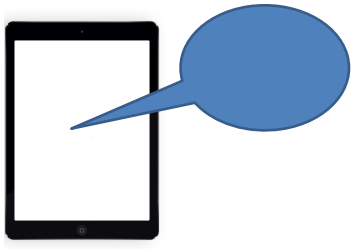

Recent research on selecting mand modality

Achmadi, D., van der Meer, L., Sigafoos, J., Lancioni, G. E., O'Reilly, M. F., Lang, R., & ... Marschik, P. B. (2015). Undergraduates' perceptions of three augmentative and alternative communication modes. *Developmental Neurorehabilitation, 18*(1), 22-25. doi:10.3109/17518423.2014.962767

Agius, M. M., & Vance, M. (2016). A comparison of PECS and iPad to teach requesting to pre-schoolers with autistic spectrum disorders. *AAC: Augmentative And Alternative Communication*, 32(1), 58-68. doi:10.3109/07434618.2015.1108363

Lorah, E. R. (2016). Comparing teacher and student use and preference of two methods of augmentative and alternative communication: Picture exchange and a speech-generating device. *Journal of Developmental And Physical Disabilities, 28*(5), 751-767. doi:10.1007/s10882-016-9507-z

Ringdahl, J. E., Berg, W. K., Wacker, D. P., Ryan, S., Ryan, A., Crook, K., & Molony, M. (2016). Further demonstrations of individual preference among mand modalities during functional communication training. *Journal of Developmental And Physical Disabilities*, 28(6), 905-917. doi:10.1007/s10882-016-9518-9

Torelli, J. N., Lambert, J. M., Da Fonte, M. A., Denham, K. N., Jedrzynski, T. M., & Houchins-Juarez, N. J. (2016). Assessing acquisition of and preference for mand topographies during functional communication training. *Behavior Analysis in Practice, 9*(2), 165-168. doi:10.1007/s40617-015-0083-y

Ringdahl et al. (2016)

18 participants (age, 4 to 6 years) with developmental disabilities and language delays

- 10 had ASD disagnoses along with mild to severe intellectual disability
- 14 were receiving functional communication training (FCT) as treatment for problem behavior; reinforcer selected based on functional analysis of problem behavior
- 4 received similar mand training unrelated to problem behavior; reinforcer selected based on preference assessment

Ringdahl et al. (2016)

Identified two potential mand topographies for each participant that they could perform with similar proficiency, for example

- Vocal
- Manual sign
- Card touch
- Microswitch press

Topographies initially taught in separate sessions

Assessed preference by making both mand topographies available simultaneously and reinforcing both

Ringdahl et al. (2016)

FIGURE

Ringdahl et al. (2016)

All participants demonstrated a preference for one of the two mand modalities

Modality preferences varied across participants

- Vocal mands were evaluated with 5 participants and preferred by 4
- Other modalities were each preferred by about half of the participants who experienced them

Individual preference should be assessed when selecting mand modality

Other Studies

Three studies compared manding via picture exchange and SGDs:

- Agius and Vance (2016); three preschoolers diagnosed with ASD successfully acquired requesting via PECS and an iPad-based SGD, but SGD communication took longer to teach; preference probes were inconclusive
- Lorah (2016); seven school-aged children with ASD and Down syndrome; equal acquisition and fidelity of use by teachers; participants and teachers more likely to prefer the iPad-based SGD to PECS
- Torelli et al. (2016); 4-year-old boy with ASD and his parents preferred iPad-based SGD to GoTalk® SGD and picture exchange during functional communication training; all were similarly effective at establishing mands and reducing aggression across escape and tangible functions

Achmadi et al. (2015); social validity study; undergraduates rated intelligibility and acceptability of SGD communication higher than picture exchange and manual signing

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Establishing Mands for Preferred Items

illustrations of.com #213194

Recent research on establishing mands for preferred items

McDonald, M. E., Battaglia, D., & Keane, M. (2015). Using fixed interval-based prompting to increase a student's initiation of the picture exchange communication system. *Behavioral Development Bulletin, 20*(2), 265-275. doi:10.1037/h0101315

Pence, S. T., & St. Peter, C. C. (2015). Evaluation of treatment integrity errors on mand acquisition. *Journal of Applied Behavior Analysis, 48*(3), 575-589. doi:10.1002/jaba.238

Plavnick, J. B., & Vitale, F. A. (2016). A Comparison of Vocal Mand Training Strategies for Children With Autism Spectrum Disorders. *Journal of Positive Behavior Interventions, 18*, 52-62.

Still, K., May, R. J., Rehfeldt, R. A., Whelan, R., & Dymond, S. (2015). Facilitating derived requesting skills with a touchscreen tablet computer for children with autism spectrum disorder. *Research In Autism Spectrum Disorders*, *19,* 44-58. doi:10.1016/j.rasd.2015.04.006

Thiemann-Bourque, K., Brady, N., McGuff, S., Stump, K., & Naylor, A. (2016). Picture exchange communication system and pals: A peer-mediated augmentative and alternative communication intervention for minimally verbal preschoolers with autism. *Journal Of Speech, Language, And Hearing Research, 59*(5), 1133-1145. doi:10.1044/2016_JSLHR-L-15-0313

Yosick, R. N., Muskat, L. R., Bowen, C. N., Delfs, C. H., & Shillingsburg, M. A. (2016). Increasing single-word requests to multiword requests in children with autism and related disabilities. *Behavioral Interventions, 31*(1), 28-43. doi:10.1002/bin.1434

Plavnick & Vitale (2016)

Does the incorporation of video modeling into mand training trials enhance mand acquisition?

Successful previous demonstration of video modeling to teach manding (Plavnick & Ferreri, 2011) followed up by comparison with a training procedure that did not require video preparation

Four children (2-3 years) diagnosed with ASD; no vocal communication and limited echoic repertoires

Targeted vocal mands for preferred items and activities

Plavnick & Vitale (2016)

In vivo condition

1. Establishing operation contrived by placing preferred item out of reach or giving the child only a part of the items needed to complete an activity
2. Progressive prompt delay: 3, 5, and 10 s
3. 15-s access to item following prompted vocal response, 30-s access following unprompted response

Video modeling condition

1. Video clip shows child manding for the participant's preferred item and mand reinforced
2. Establishing operation contrived
3. 30-s access to item following unprompted response
4. No prompt or other consequence if no or incorrect response
5. Video model faded after 3 consecutive correct mands, by delaying its presentation for 3, 5, and 10 s after contriving establishing operation

Plavnick & Vitale (2016)

FIGURE

All participants mastered more mands in the video modeling condition

Role of differential reinforcement and prompt-fading procedures?

Training time and total trials not reported

Other studies

Thiemann-Bourque et al. (2016) taught four children to use PECS to initiate communication with peers using prompts, prompt-fading, and peer training

- PECS previously mastered at level III, IV, or V
- Peers were same-age typically developing children
- All participants learned to initiate communication with peers
- Peers' spontaneous initiations to the participants with ASD also increased

McDonald et al. (2015): A 6-year-old boy with ASD had mastered PECS Phase IV but did not approach PECS book or initiate PECS communication spontaneously; a fixed-interval prompting procedure produced an increase in spontaneous PECS use

Other studies

Still et al. (2016) taught participants to mand for needed items using picture selection on a touchscreen computer, and then to

(a) select each picture given its dictated name, and

(b) select the printed name of each item given its dictated name

10 of 11 participants (children, 3-12 years, ASD) subsequently manded for the missing items by selecting their printed names

Yosick et al. (2016) evaluated the effects of behavioral intervention mean length of utterance (MLU) in vocal manding, using retrospective analysis of existing data on 30 children whose MLU had been targeted for intervention. MLU increased with intervention; the effect was strong for a majority of theparticipants.

Other studies

Pence and St. Peter (2015) evaluated the effects of treatment integrity on vocal mand acquisition in two experiments; 3 of 6 participants had ASD diagnoses

- Taught to use nonsense names to mand for preferred toys
- Mand acquisition was slower in conditions with programmed treatment integrity lapses, such as intermittent delivery of incorrect toy or response-independent delivery of toy
- These lapses represent events that may occur commonly in in home and other non-treatment settings

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Promoting Variability in the Form of Manding

Why is variability in the form of manding beneficial?

Invariant mand topographies may reduce access to reinforcement in the natural environment

Multiple appropriate mand topographies for the same reinforcers may prevent resurgence of disruptive, previously extinguished mand topographies when reinforcement is delayed or omitted

Recent research on promoting mand variability

Adami, S., Falcomata, T. S., Muething, C. S., & Hoffman, K. (2017). An evaluation of lag schedules of reinforcement during functional communication training: Effects on varied mand responding and challenging behavior. *Behavior Analysis in Practice*, doi:10.1007/s40617-017-0179-7

Brodhead, M. T., Higbee, T. S., Gerencser, K. R., & Akers, J. S. (2016). The use of a discrimination-training procedure to teach mand variability to children with autism. *Journal of Applied Behavior Analysis, 49*(1), 34-48. doi:10.1002/jaba.280

Chezan, L. C., Drasgow, E., Martin, C. A., & Halle, J. W. (2016). Negatively-Reinforced Mands: An Examination of Resurgence to Existing Mands in Two Children With Autism and Language Delays. *Behavior Modification*, 40, 922-953.

Drasgow, E., Martin, C. A., Chezan, L. C., Wolfe, K., & Halle, J. W. (2016). Mand Training: An Examination of Response-Class Structure in Three Children With Autism and Severe Language Delays. *Behavior Modification, 40*, 347-376.

Sellers, T. P., Kelley, K., Higbee, T. S., & Wolfe, K. (2016). Effects of simultaneous script training on use of varied mand frames by preschoolers with autism. *The Analysis of Verbal Behavior, 32*(1), 15-26. doi:10.1007/s40616-015-0049-8

Drasgow et al. (2016)

Will teaching children to alternate between two mand forms prevent resurgence to pre-existing mands when the newly acquired mands are not reinforced immediately?

Three children with ASD (3-4 years); ASD in severe range; no vocal communication; no AAC communication; manded for items and activities by leading and reaching

Taught to emit signed mands corresponding to “please” and “more” to access a variety of highly preferred foods

Assessed mand forms that occurred under (a) immediate reinforcement and (b) 6-7 s delay to reinforcement, following which first mand was reinforced

Drasgow et al. (2016)

Circles = Existing Mands Squares = "More" Diamonds = "Please"

In delayed-reinforcement trials, participants were taught to substitute "please" when "more" did not produce reinforcement and vice versa

FIGURE

Drasgow et al. (2016)

What happened in delayed-reinforcement trials when the first response was not reinforced?

FIGURE

Drasgow et al. (2016)

What happened in delayed-reinforcement trials when the first response was not reinforced?

FIGURE

Drasgow et al. (2016)

All participants successfully acquired the two mands and emitted them in the presence of novel social partners

All participants learned to alternate between the two mands when the first mand emitted in a trial was not reinforced, but only two continued to alternate in the subsequent test condition

- Generalization of alternation to novel social partners
- The third participant persisted in repeating the first mand ("more" or "please")

There was minimal resurgence of leading and reaching, even after only a single mand form had been taught

- Brief delays to reinforcement

Other Studies

Chezan et al. (2016): Similar to Drasgow et al. (2016) but targeted negatively reinforced mands.

- Existing form: Pushing nonpreferred item away
- New forms: Picking up a rejection card, and shaking head
- Both participants learned both mand forms; one of two alternated between them in delayed test condition

Sellers et al. (2016) targeted variability in mand frames

- "I want . . ." (most participants' default frame) vs. "May I have . . .", "I would like . . .", "Please give me . . ."
- Used textual scripts and script fading to teach three new frames simultaneously, as opposed to one by one (Betz et al., 2011)
- For 3 of 6 participants, there was increased variability in mand frames when all forms were reinforced
- For 2 additional participants, variability increased when extinction was implemented for repeating a mand form within a session

Other Studies

Brodhead et al. (2016) also used textual scripts and script-fading to teach three new mand frames

- Lag 2 or 3 reinforcement schedule vs. "no vary" condition in which only the default mand was reinforced
- Varied responding consisted in the presence of discriminative stimuli (colored placemats) that signaled these contingencies, even when all response forms were reinforced

FIGURE

Other Studies

Adami et al. (2017) also found increased variability in mand forms under a Lag 1 schedule of reinforcement compared to when all mand forms were reinforced

- Context: Functional Communication Training
- Functionally equivalent problem behavior not affected

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Decreasing High Rates of Manding

Mands sometimes occur at impractically high rates

High-rate reinforcement may be impossible or carry health risk

Recent research on decreasing high rates of manding

Chezan, L. C., Drasgow, E., Legg, J., & Holborn, A. (2016). Effects of Conditional Discrimination Training and Choice Opportunities on Manding for Two Young Children with Autism Spectrum Disorder and Language Delays. *Journal of Developmental and Physical Disabilities, 28*, 557-579.

Landa, R., & Hanley, G. P. (2016). An evaluation of multiple-schedule variations to reduce high-rarequests in the picture exchange communication system. *Journal of Applied Behavior Analysis, 49*(2), 388-393. doi:10.1002/jaba.285

Vladescu, J. C., & Kodak, T. (2016). The effect of a multiple-schedule arrangement on mands of a child with autism. *Behavioral Interventions, 31*(1), 3-11. doi:10.1002/bin.1422

Landa & Hanley (2016)

Several previous studies have evaluated the effects of *multiple* schedules to decrease rates of manding

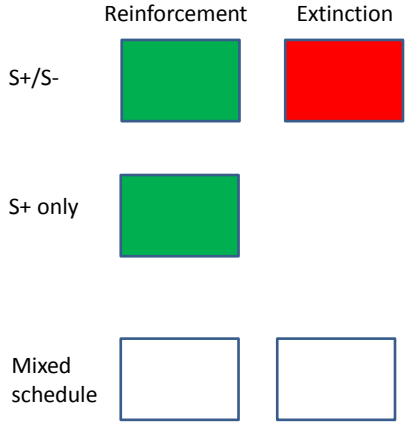
In a study on typically developing prechoolers´mands for teacher attention, Tiger, Hanley & Heal (2006) compared two variations of multiple-schedule arrangements:

- Discrete stimuli signaling both reinforcement and extinction (S+/S- condition) vs. reinforcement only (S+)
- Both variations reduced rates of manding more effectively than a *mixed* schedule, but participants preferred the S+ variation

Landa & Hanley (2016)

This study was a replication of Tiger et al. (2006) with two adolescents diagnosed with ASD using PECS to mand for preferred edibles

- Schedule-correlated stimuli were colored pages placed under communication page in PECS binder



Landa & Hanley (2016)

In all conditions, schedule components in each session alternated randomly across reinforcement and extinction for 15, 30, or 45 s

All mands reinforced during reinforcement (FR 1)

Communication icon replaced in book during extinction

Reinforcement 15 s
Extinction 30 s
Reinforcement 45 s
Extinction 15 s
Excinction 45 s
Reinforcement 30 s

3- min session

Order within sessions equated across conditions

Landa & Hanley (2016)

FIGURE

Landa & Hanley (2016)

The S+ only arrangement was the only one that produced discriminated manding for Jack, and produced the highest level of discrimination for Max

For Max, the schedule was thinned to 1 min of reinforcement to 30 min of extinction while manding remained low (no data on problem behavior)

Supports signaling periods of availability of reinforcement for manding, but may not support requiring a discrimination between discrete signals for availability and unavailability

Did not include a S- only condition (signaling unavailability but not availability)

Other Studies

Chezan et al. (2016) and Vladescu and Kodak (2016) also evaluated multiple-schedule arrangements.

Chezan et al. (2016) achieved discriminated manding of two participants under an S+/S- signaling arrangement; successfully increased extinction duration while providing alternative activities during the S-.

Vladescu and Kodak (2016) used naturalistic activities (adult working, talking on phone, attending to baby doll) + a verbal rule to signal extinction under an S- arrangement; achieved discriminated manding across all S- stimuli and successfully increased extinction duration.

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

1. Establishing functional vocalizations and improving echoic repertoires (3)
2. Selecting appropriate mand modality (5)
3. Establishing mands for preferred items (6)
4. Promoting variability in the form of manding (5)
5. Decreasing high rates of manding (3)
6. Teaching mands for information (4)
7. Procedural variables in tact and intraverbal instruction (8)
8. Establishing complex stimulus control over intraverbals and tacts (7)
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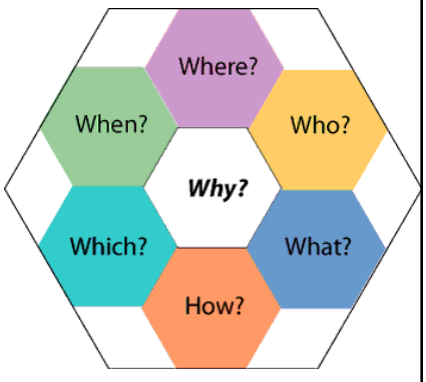
11. Teaching conversation skills (4)
12. The PEAK® curriculum (14)

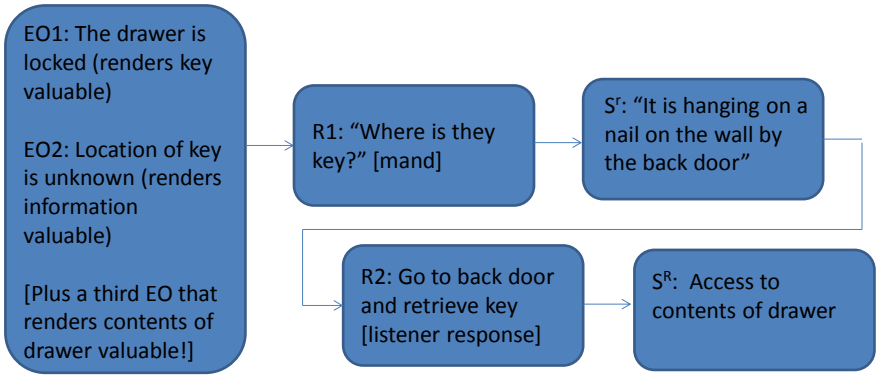
Teaching Mands for Information

Sometimes the reinforce for a mand is verbally provided information

May take the form of wh-questions or a more general request (e.g., "I don't know, please tell me"; e.g., Ingvarsson & Hollobaugh, 2010)

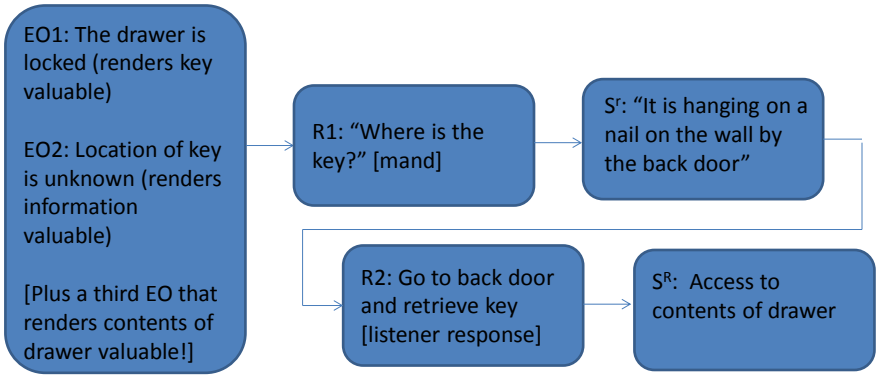


A mand under the functional control of a condition (EO) that renders *information* valuable (because in the presence of the information, effective action is possible)



What if you have no need for the content of the drawer? What if the drawer is unlocked? What if you already know where the key is? These *abolishing operations* should decrease the probability of manding for information.

To verify that you have truly taught an *MFI*, you need to demonstrate that it occurs more under EO than AO conditions



Recent research on teaching mands for information

Carnett, A., & Ingvarsson, E. T. (2016). Teaching a child with autism to mand for answers to questions using a speech-generating device. *The Analysis of Verbal Behavior*, *32*, 233-241.

Landa, R. K., Hansen, B., & Alice Shillingsburg, M. (2017). Teaching mands for information using 'when' to children with autism. *Journal of Applied Behavior Analysis*, doi:10.1002/jaba.387

Shillingsburg, M. A., Frampton, S. E., Wymer, S. C., & Bartlett, B. (2016). A preliminary procedure for teaching children with autism to mand for social information. *Behavior Analysis in Practice*, doi:10.1007/s40617-016-0163-7

Shillingsburg, M. A., Gayman, C. M., & Walton, W. (2016). Using textual prompts to teach mands for information using 'who?'. *The Analysis Of Verbal Behavior, 32*(1), 1-14.

Landa et al. (2017)

A previous study (Shillingsburg et al., 2011) demonstrated a procedure for teaching children to mand "when?" but did not include a conclusive demonstration of functional control by a relevant EO; Landa et al. (2017) addressed that limitation.

Three children (6-7 years) diagnosed with ASD; two had some other mands for information ("What?" "Who?" "Which?") in their repertoires and one did not

Target behavior was asking "When?" when a mand for a preferred item was denied with statements like "Not right now" or "You can have that later"

Landa et al. (2017)

The consequence for asking "When?" was a contingency-specifying statement such as "After you wash your hands."

Prior to teaching the "When?" mand, participants were taught to respond to the contingency-specifying statements by completing the task.

Chips visible but out of reach	May I have chips?	Not right now; after you put away your toys	Put away toys	May I have chips?	Access to chips for 30 s

Landa et al. (2017)

EO present "When" instructional trials:

Chips visible but out of reach	May I have chips?	Not right now	When?	After you put away your toys	Put away toys

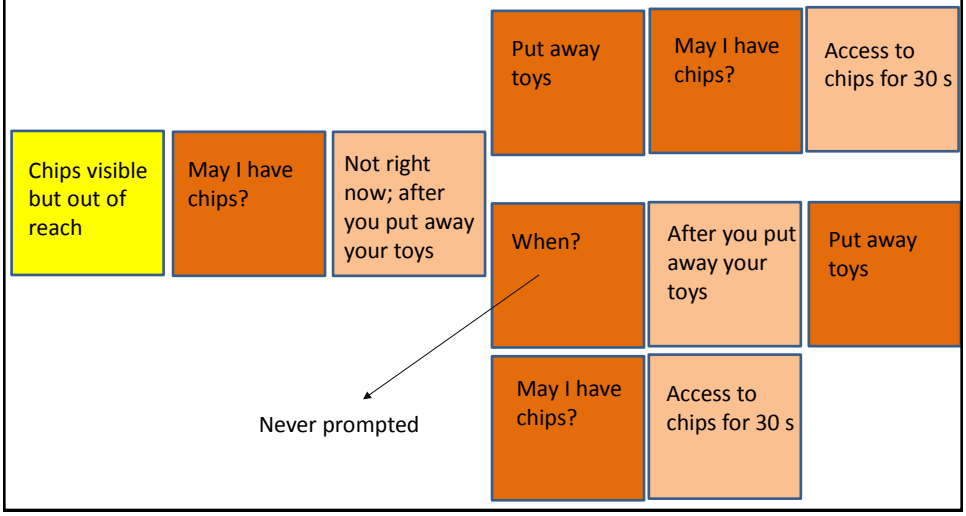
May I have chips?	Access to chips for 30 s

Taught via prompt delay (0, 1, 3 s)
Textual or echoic prompts

If the participant correctly guessed and completed the behavioral requirement without asking "When?", a subsequent mand was reinforced; however, this was unlikely to happen as there were five different behavior requirements.

Landa et al. (2017)

EO absent "When" instructional trials:



Landa et al. (2017)

FIGURE

Landa et al. (2017)

FIGURE

Landa et al. (2017)

All three participants acquired the “When?” mand and emitted them exclusively or almost exclusively in EO present trials

Only after acquiring this mand were participants able to complete the behavior requirement and successfully mand for the reinforcer in EO present trials

In baseline, mands for the item (“May I have chips?”) persisted after the request was denied in EO present trials; learning to mand “When?” decreased this inappropriate manding

Did not include information that was actually related to time

Other Studies

Shillingsburg, Gayman et al. (2016) used textual prompts to teach "Who?" mands for information to four children with ASD; all participants successfully acquired the target response and emitted it in EO present but not EO absent trials.

Shillingsburg, Frampton et al. (2016) taught two children with ASD to mand for social information.

Carnett & Ingvarsson (2016) taught an 11-year-old boy to type "I don't know, please tell me" into an SGD when asked a question to which he did not know the answer. He acquired the response, emitted it only in response to unknown questions, and ultimately learned to answer the previously unknown questions.

BREAK

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

1. Establishing functional vocalizations and improving echoic repertoires (3)
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Procedural Variables in Tact and Intraverbal Instruction

New tacts and intraverbals are often taught in discrete-trial format

Tacts and intraverbals are often used as acquisition targets in research on procedural variables in discrete-trial instruction

In the next group of studies, some address variables that may be generally applicable to teaching many skills; others address variables more specific to teaching tacts and intraverbals

Recent research on procedural variables in tact and intraverbal instruction

Boudreau, B. A., Vladescu, J. C., Kodak, T. M., Argott, P. J., & Kisamore, A. N. (2015). A comparison of differential reinforcement procedures with children with autism. *Journal of Applied Behavior Analysis, 48*(4), 918-923. doi:10.1002/jaba.232

Cihon, T. M., White, R., Zimmerman, V. L., Gesick, J., Stordahl, S., & Eshleman, J. (2017). The effects of precision teaching with textual or tact relations on intraverbal relations. *Behavioral Development Bulletin, 22*(1), 129-146. doi:10.1037/bdb0000056

Cariveau, T., Kodak, T., & Campbell, V. (2016). The effects of intertrial interval and instructional format on skill acquisition and maintenance for children with autism spectrum disorders. *Journal of Applied Behavior Analysis, 49*(4), 809-825. doi:10.1002/jaba.322

Giunta-Fede, T., Reeve, S. A., DeBar, R. M., Vladescu, J. C., & Reeve, K. F. (2016). Comparing continuous and discontinuous data collection during discrete trial teaching of tacting by children with autism. *Behavioral Interventions, 31*(4), 311-331. doi:10.1002/bin.1446

Johnson, K. A., Vladescu, J. C., Kodak, T., & Sidener, T. M. (2017). An assessment of differential reinforcement procedures for learners with autism spectrum disorder. *Journal of Applied Behavior Analysis, 50*(2), 290-303. doi:10.1002/jaba.372

Leaf, J. B., Townley-Cochran, D., Mitchell, E., Milne, C., Alcalay, A., Leaf, J., & ... Oppenheim-Leaf, M. L. (2016). Evaluation of multiple-alternative prompts during tact training. *Journal of Applied Behavior Analysis, 49*(2), 399-404. doi:10.1002/jaba.289

Majdalany, L., Wilder, D. A., Smeltz, L., & Lipschultz, J. (2016). The effect of brief delays to reinforcement on the acquisition of tacts in children with autism. *Journal of Applied Behavior Analysis, 49*(2), 411-415. doi:10.1002/jaba.282

Vedora, J., & Conant, E. (2015). A comparison of prompting tactics for teaching intraverbals to young adults with autism. *The Analysis of Verbal Behavior, 31*(2), 267-276. doi:10.1007/s40616-015-0030-6

Cariveau et al. (2016)

Evaluated the effects of
- massed vs. varied instructional trials
- intertrial interval duration

on acquisition of tacts and intraverbals

Two children (7 and 9 years) diagnosed with ASD

Instructional targets were animal sound intraverbals for one participants and novel tacts (kitchen items) for the other
- 24 unmastered targets assigned to 6 conditions
- Taught using progressive prompt delay with terminal value of 10-s, and differential reinforcement of unprompted responses after the first unprompted correct response

Cariveau et al. (2016)

Massed trials condition:

The same instructional target presented in all nine trials within a session

Varied trials condition:

Three instructional targets presented three times each within each session; no target presented more than two times consecutively

Short ITI: Each trial initiated 2 s after end of reinforcement interval for previous trial

Long ITI: Each trial initiated 20 s after end of reinforcement interval for previous trial

Progressive ITI: Short ITI until 2 s prompt delay; then gradually increased until it reached 20 s

Cariveau et al. (2016)

FIGURE

Cariveau et al. (2016)

Varied trials generally produced faster acquisition than massed trials

- This effect was particularly pronounced when ITI was long

Overall, fast-paced instruction with varied targets produced the fasted acquisition

Generalization and maintenance varied across participants and targets with no consistent effect of condition or ITI

Other Studies

Boudreau et al. (2015) and Johnson et al. (2017) compared the effects of differential reinforcement procedures on acquisition of tacts and intraverbals

- Larger magnitude of reinforcement, higher quality reinforcement, or denser schedule of reinforcement (Johnson et al. only) for unprompted than prompted responses
- Also included nondifferential reinforcement conditions in which larger magnitude/higher quality/denser schedule was delivered for both unprompted and prompted responses
- Boudreau et al. (2015) found that participants acquired all target responses; no consistent effect of type of procedure, and nondifferential reinforcement was not detrimental
- Johnson et al. (2017) found that an assessment that identified the "best" procedure for teaching listener behavior predicted which procedure would produce fastest acquisition of future listener targets, but NOT tact or intraverbal targets

Other Studies

Majdalany et al. (2017) evaluated the effects of delays to reinforcement on tact acquisition. Delays as brief as 6 s were detrimental to acquisition for two of three participants.

Leaf et al. (2016) evaluated the effects of "multiple-alternative" prompts following error responses on tact acquisition

- E.g., "Is it a hammer, a drill, or a screwdriver?"
- Compared to conventional vocal prompt (e.g., "drill")
- Trials to criterion and teaching time equal in both conditions
- Slightly better maintenance of tacts taught with multiple-alternative prompt

Other Studies

Vedora and Conant (2015) compared the efficacy of visual (tact or textual) prompts and echoic prompts on the intraverbal acquisition of three young adults diagnosed with ASD

- Fastest acquisition in echoic condition for one participant, textual for one participant, and equal in both conditions for one participant
- Possible role of instructional history (Coon & Miguel, 2012)

Cihon et al. (2017) found that the effectiveness of textual prompts when teaching intraverbals did not depend on the fluency of the textual response

Other Studies

Giunta-Fede et al. (2016) found that for 2 of 3 participants, collecting data on all responses during tact training was associated with faster acquisition than collecting first-trial data only; no differences in generalization or maintenance.

Studies Identified

TOTAL OF 70 ARTICLES!

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Complex Stimulus Control over Tacts and Intraverbals

A simple tact or intraverbal involves a single response unit under the control of a single stimulus

But often an appropriate verbal response is controlled by multiple stimuli present in the situation, or responses controlled by different stimuli must be emitted in rapid succession

Examples:

(a) Subject-verb sentence construction (e.g., "the boy is jumping") requires rapidly tacting multiple stimuli present in the situation in a specific order

(b) A tact or an intraverbal response considered correct or appropriate in a situation may require control by multiple stimulus elements

Recent research on establishing complex stimulus control over tacts and intraverbals

Conallen, K., & Reed, P. (2016). A teaching procedure to help children with autistic spectrum disorder to label emotions. *Research In Autism Spectrum Disorders, 23*, 63-72. doi:10.1016/j.rasd.2015.11.006

Contreras, B. P., & Betz, A. M. (2016). Using lag schedules to strengthen the intraverbal repertoires of children with autism. *Journal of Applied Behavior Analysis, 49*, 3-16.

Frampton, S. E., Wymer, S. C., Hansen, B., & Shillingsburg, M. A. (2016). The use of matrix training to promote generative language with children with autism. *Journal of Applied Behavior Analysis*, 49(4), 869-883. doi:10.1002/jaba.340

Haggar, J., Ingvarsson, E. T., & Braun, E. C. (2017). Further evaluation of blocked trials to teach intraverbal responses under complex stimulus control: Effects of criterion-level probes. *Learning And Motivation*, doi:10.1016/j.lmot.2017.02.006

Ingvarsson, E. T., Kramer, R. L., Carp, C. L., Petursdottir, A. I., & Macias, H. (2016). Evaluation of a blocked-trials procedure to establish complex stimulus control over intraverbal responses in children with autism. *The Analysis of Verbal Behavior,* 32, 205-224.

Kisamore, A. N., Karsten, A. M., & Mann, C. C. (2016). Teaching multiply controlled intraverbals to children and adolescents with autism spectrum disorders. *Journal of Applied Behavior Analysis*, *49*(4), 826-847. doi:10.1002/jaba.344

Pauwels, A. A., Ahearn, W. H., & Cohen, S. J. (2015). Recombinative generalization of tacts through matrix training with individuals with autism spectrum disorder. *The Analysis of Verbal Behavior, 31*(2), 200-214.

Ingvarsson et al. (2016)

Targeted intraverbal responses to question pairs that required discrimination of verb alone *vs*. verb + "with"

- What do you sweep?
- What do you sweep with?
- What do you eat?
- What do you eat with?

Four children (6-8 years) diagnosed with ASD; had previously mastered a number of intraverbal programs, but had difficulty with questions requiring control by multiple stimuli

Evaluated the use of a blocked-trials procedure to establish discrimination

Ingvarsson et al. (2016)

Step 3 (Always presented first):

- First question presented until 5 consecutive correct responses
- Second question presented until 5 consecutive correct responses
- Advancement criterion: four consecutive errorless trial blocks

Step 4: Questions asked in counterbalanced blocks of 2 and 3 trials

- Advancement criterion: 15 consecutive correct responses

Step 5: Semi-random presentation

- Mastery criterion: 15 consecutive correct responses

Ingvarsson et al. (2016)

Steps 1 and 2 conducted only if no success in Step 3 (one participant)

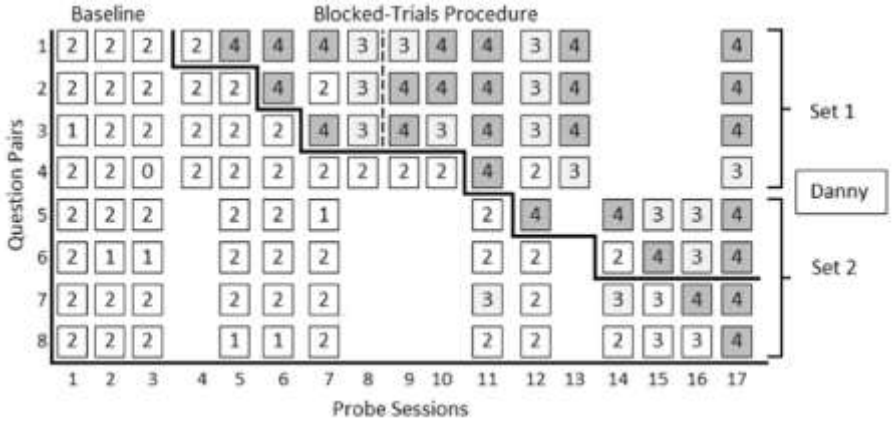
Step 1: Each question asked until 10 consecutive correct responses

- Advancement criterion: Four consecutive trials blocks with no more than 2 errors

Step 2: Each question asked until 8 consecutive correct responses

- Advancement criterion: Four consecutive trials blocks with no more than 1 error

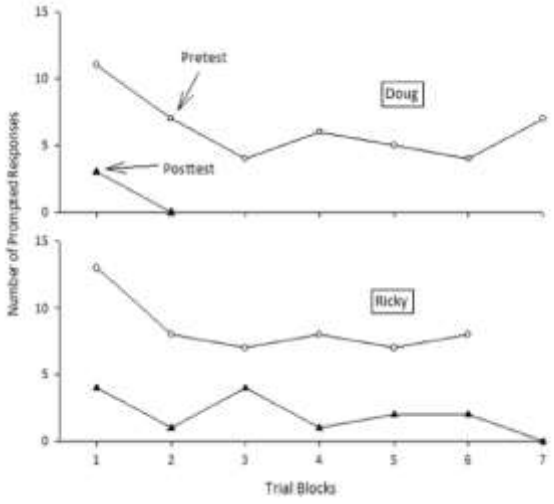
Ingvarsson et al. (2016)



Ingvarsson et al. (2016)

Criterion-Level Probes

Two participants' performance in Step 5 instruction with novel question pairs before and after the blocked-trials protocol was implemented



Ingvarsson et al. (2016)

All participants acquired the target intraverbals with the blocked-trials procedure

- Remedial procedures were needed in some cases (e.g., inserting distractor trials between trial blocks in Step 5 to eliminate "win-stay" strategy)

Generalization to untrained targets was limited

However, two participants received post-training criterion-level (Step 5) probes with novel question pairs and no longer required blocked-trials to acquire them

- Limitation: Blocked-trials instruction may have continued longer than necessary for new question pairs

Other Studies

Haggar et al. (2017) replicated Ingvarsson et al. (2016) with criterion-level probes after each step of the blocked-trials procedure to determine the point at which blocked-trial instruction was no longer necessary.

- Two participants acquired all targets, and after the first discrimination was established, the full protocol was rarely necessary to teach additional discriminations

Other Studies

Kisamore et al. (2016) also taught intraverbal responses that required control by multiple components of the verbal stimulus:

- What's an animal that's red?
- What's an animal that's yellow?
- What's a vehicle that's red?
- What's a vehicle that's yellow?

3 of 7 participants acquired all targets using a prompt delay plus error correction procedure

4 participants required additional procedures that included differential observing responses and modifications of the prompt delay procedure

Other Studies

Contreras & Betz (2016) addressed variability in intraverbal "listing" responses to category questions

- Participants exhibited rote responses such as always answering "cat, dog, pig" when asked "tell me some animals."
  - Lacking supplemental sources of control that might promote variable responding
- For two of three participants, lag reinforcement schedules were sufficient to increase variability, and one participant also emitted novel responses without any additional instruction
- The third participant required training (prompt delay) to contact reinforcement under the lag contingency

Other Studies

Frampton et al. (2016) and Pauwels et al. (2015) evaluated the effects of matrix training on recombinative generalization when teaching children to emit phrases that required

- Tacting items and their relative location (Pauwels et al), e.g., "the strainer is to the right of the box"
- Tacting an actor performing an action (Frampton et al.), e.g., "cat jumping"

	Jump	Run	Sleep	Eat
Cat	TRAIN			
Boy		TRAIN		
Dog			TRAIN	
Pig				TRAIN

Most participants in both studies showed recombinative generalization (white cells) after the first matrix was trained; the remainder did so after additional training

Frampton et al. also demonstrated generalization to matrixes in which no verbs or nouns had been trained

Other Studies

Conallen and Reed (2016) evaluated a procedure for teaching children with ASD to tact emotions using iconic picture cards

- 10 children who did not communicate vocally
- Taught to match situation cards to emotion cards and vice versa (selection-based tacts)
- Generalization to novel situation cards, and to selecting novel situation cards that matched their individual preferences when asked "What makes you happy?" etc.

Studies Identified

TOTAL OF 70 ARTICLES!

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Emergence of Untaught Tacts and Intraverbals

Verbal or nonverbal stimuli evoke responses that have not been previously been reinforced, as a result of something else being taught

- Under which circumstances can we expect this to happen? Prerequisite skills?
- If emergent tacts or intraverbals are not observed, can we teach skills that promote emergence?

Recent research on the emergence of untaught tacts and intraverbals

Cihon, T. M., White, R., Zimmerman, V. L., Gesick, J., Stordahl, S., & Eshleman, J. (2017). The effects of precision teaching with textual or tact relations on intraverbal relations. *Behavioral Development Bulletin, 22*(1), 129-146. doi:10.1037/bdb0000056

Dickes, N. R., & Kodak, T. (2015). Evaluating the emergence of reverse intraverbals following intraverbal training in young children with autism spectrum disorder. *Behavioral Interventions*, *30*(3), 169-190. doi:10.1002/bin.1412

Frampton, S. E., Robinson, H. C., Conine, D. E., & Delfs, C. H. (2017). An abbreviated evaluation of the efficiency of listener and tact instruction for children with autism. *Behavior Analysis in Practice, 10*(2), 131-144. doi:10.1007/s40617-017-0175-y

Lee, G. P., Miguel, C. F., Darcey, E. K., & Jennings, A. M. (2015). A further evaluation of the effects of listener training on derived categorization and speaker behavior in children with autism. *Research In Autism Spectrum Disorders*, *19*, 72-81.

Shillingsburg, M. A., Frampton, S. E., Cleveland, S. A., & Cariveau, T. (2017). A clinical application of procedures to promote the emergence of untrained intraverbal relations with children with autism. *Learning And Motivation*, doi:10.1016/j.lmot.2017.02.003

Olaff, H. S., Ona, H. N., & Holth, P. (2017). Establishment of naming in children with autism through multiple response-exemplar training. *Behavioral Development Bulletin, 22*(1), 67-85. doi:10.1037/bdb0000044

Smith, D. P., Eikeseth, S., Fletcher, S. E., Montebelli, L., Smith, H. R., & Taylor, J. C. (2016). Emergent intraverbal forms may occur as a result of listener training for children with autism. *The Analysis of Verbal Behavior, 32*(1), 27-37. doi:10.1007/s40616-016-0057-3

Shillingsburg et al. (2017)

Effects of listener and tact instruction on the emergence of bidirectional intraverbal relations

Six children (4-8 years) diagnosed with ASD, mostly at Level 2 on VB-MAPP

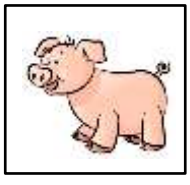
Examples of target relations:

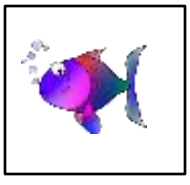
- Who lives in the sea? / Where does a fish live?
- Who says woof? / What does a dog say?

Shillingsburg et al. (2017)

Listener Training/Probes

"Who lives in the sea?"



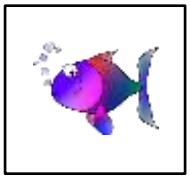


[Not the actual stimuli used in the study]

Shillingsburg et al. (2017)

Tact Training/Probes

"Where does this one live?"



Shillingsburg et al. (2017)

Intraverbal Training/Probes

"Where does a fish live?"

"Who lives in the sea?"

Taught sequentially

Shillingsburg et al. (2017)

All participants showed some emergence of untrained intraverbal relations after tact training and/or listener training, and in a few cases the emergence of the second (reverse) intraverbal after the first was trained

- Across participants and stimulus sets, between 1/6 and 6/6 relations emerged without training

For three participants, no tacts or intraverbals emerged for the **first stimulus set** until they were taught directly

- Began to emerge following listener and/or tact training when the procedure was repeated with additional sets

For three participants, some intraverbals emerged following listener and/or tact training on the first set

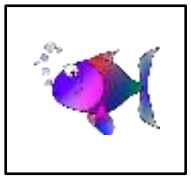
- Two showed improvement across sets

Four participants also demonstrated some emergence of untrained intraverbals on sets that had not been trained at all

Shillingsburg et al. (2017)

Tact training was more likely to result in emergence of the intraverbal that shared a response form with the tact than the reverse intraverbal

"Where does this one live?"



⇢ "Where does a fish live?"

Shillingsburg et al. (2017)

Listener training was more likely to result in the emergence of the intraverbal in which the response corresponded to a tact of the stimulus selected in listener training

"Who lives in the sea?"

"Who lives in the sea?"

Other Studies

Smith et al. (2016) found that function/feature intraverbals emerged following listener training for 4 of 5 participants (age 5-15 years)

- Emerged for the 5th participant after probing procedure was modified

Cihon et al. (2017):

- Study 2 (one participant) found emergence of intraverbal questions about categories (e.g., "What are some vehicles?") after the participant learned to tact items within a category to a fluency criterion

Other Studies

Dickes & Kodak (2015) taught intraverbal responses to questions about opposites, functions, and animal sounds and assessed the emergence of reverse intraverbals

- All participants showed some, but limited, emergence of reverse intraverbals
- Directly training a subset of reverse intraverbals did not improve outcome of further training of original intraverbals

Other Studies

Frampton et al. (2017) investigated the relative efficiency of listener training and tact training for establishing both tacts and listener behavior

- Tact training was more efficient than listener behavior for 6 of 8 participants
- Tact training and listener training were equivalent for 2 of 8 participants

Olaff et al. (2017) found that after multiple-exemplar training, there was increased emergence of tacts and listener relations performing an identity matching task with novel objects while echoing their names

Other Studies

Lee et al. (2015) replicated a previous study by Kobari-Wright and Miguel on the effects of listener training on tact emergence and nonverbal categorization

- Two participants who passed the test for emergent category tacts were also able to nonverbally match stimuli from the same category
- Two participants failed both tests; these participants had substantially lower scores on standardized language assessment (24-30 months, compared to 45-65 months)

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

1. Establishing functional vocalizations and improving echoic repertoires (3)
2. Selecting appropriate mand modality (5)
3. Establishing mands for preferred items (6)
4. Promoting variability in the form of manding (5)
5. Decreasing high rates of manding (3)
6. Teaching mands for information (4)
7. Procedural variables in tact and intraverbal instruction (8)
8. Establishing complex stimulus control over intraverbals and tacts (7)
9. Emergence of untaught intraverbals and tacts (7)
10. Using instructive feedback to expand verbal repertoires (5)
11. Teaching conversation skills (4)
12. The PEAK® curriculum (14)

What is Instructive Feedback?

A discrete trial consists of the presentation of

a stimulus → *Intended to acquire discriminative control over target response*

a response → *Well-defined target response*

a consequence → *Praise (+ tangible item or token) or response to error (e.g., prompt)*

Instructive feedback refers to incorporating information that is extraneous to the target operant into some portion of the instructional trial.

Recent research on instructive feedback

Haq, S. S., Zemantic, P. K., Kodak, T., LeBlanc, B., & Ruppert, T. E. (2017). Examination of variables that affect the efficacy of instructive feedback. *Behavioral Interventions*, doi:10.1002/bin.1470

Leaf, J. B., Cihon, J. H., Alcalay, A., Mitchell, E., Townley-Cochran, D., Miller, K., & ... McEachin, J. (2017). Instructive feedback embedded within group instruction for children diagnosed with autism spectrum disorder. *Journal of Applied Behavior Analysis, 50*(2), 304-316. doi:10.1002/jaba.375

Nottingham, C. L., Vladescu, J. C., Kodak, T., & Kisamore, A. N. (2017). Incorporating multiple secondary targets into learning trials for individuals with autism spectrum disorder. *Journal of Applied Behavior Analysis*, doi:10.1002/jaba.396

Tullis, C. A., Frampton, S. E., Delfs, C. H., & Shillingsburg, M. A. (2017). Teaching problem explanations using instructive feedback. *The Analysis of Verbal Behavior, 33*(1), 64-79. doi:10.1007/s40616-016-0075-1

Therapist: What is this?

Student: A cat

Therapist: That's right! And a cat says meow.

IF stimulus, a.k.a. secondary target

Student is not required to respond

Later we test to see if the student can respond intraverbally to "A cat says . . ."

Instructive feedback in antecedent portion of trial:

Therapist: A cow says moo, but a cat says what?

Student: Meow

Therapist: That's right!

What is Instructive Feedback?

Has been around for a long time (e.g., Gast et al., 1994; Wolery et al., 1991),

Research has only recently begun to extend previous findings to discrete-trials instruction with children diagnosed with ASD (e.g., Reichow & Wolery, 2011; Vladescu & Kodak, 2013)

Nottingham et al. (2017)

Incorporating multiple IF stimuli into a single trial

Two children (5 and 8 years) with ASD diagnoses

Primary and secondary targets were unknown tacts (e.g., mango, pinecone, hammock)

Secondary tacts tested at the beginning of each instructional session without feedback or reinforcement

Four instructional conditions:

- No secondary targets
- IF stimulus in consequence portion of trial
- Two IF stimuli in consequence portion of trial
- One IF stimulus in the consequence and one in the antecedent portion of the trial
- No-instruction control

Nottingham et al. (2017)

FIGURE

Similar results for both participants

Including secondary targets did not interfere with acquisition of primary target

Kelly acquired all three secondary targets and Simon acquired 5 of 6 secondary targets without instruction

No systematic differences between conditions

Nottingham et al. (2017)

FIGURE

By incorporating secondary targets into instructional trials, more can be taught in less time

- Does not have to be in the form of "feedback" (i.e., consequence portion)
- OK to include information on two secondary targets in the same trial
- Consistent with other studies on instructive feedback

Other Studies

Tullis et al. (2017) used instructive feedback in the consequence portion of trials to teach problem explanations to children with ASD

- Primary target was the selection of a picture card depicting a "problem" from an array of cards (e.g., "Show me the problem")
- Secondary target was stating why the scenario depicted in the picture was a problem.
- Probed every two treatment sessions under extinction ("Why is this a problem?") and trained if not acquired with IF alone
- One participant acquired all secondary targets with IF alone; the other two required direct training on first set but not on the others

Other Studies

Leaf et al. (2017): Implementation of IF during group instruction

- Nine participants (age 4 to 7 years) with ASD diagnoses but normal IQ and age-appropriate language skills
- Primary targets were tacts of comic book characters and professional basketball players; secondary targets were information on hero's superpower or player's team
- Instructed in groups of 3 children, trials delivered to one child at a time while others observed
- Participants acquired both primary and secondary targets
- Also acquired observational primary and secondary targets (those taught to other members of their group)

Other Studies

Haq et al. (2017): What explains acquisition of the secondary target?

- Is it related to participant behavior during instructive feedback?
- Tacts were primary and secondary targets for one participant; preliminary evidence that attending to the visual stimulus was related to secondary target acquisition
- Intraverbals were primary and secondary targets for another participant; no evidence that echoing IF stimulus was related to secondary target acquisition

Future research might take a closer look at prerequisites from benefitting from instructive feedback.

Other Studies

Carroll & Kodak (2015) used instructive feedback to increase variability of intraverbal "listing" responses

- Similar to Contreras & Betz (2016), participants exhibited rote responses to category questions
- Instructive feedback consisted of modeling additional response options after a correct response (e.g., "Pink, orange, and green are colors too")
- Both participants' novel response combinations and novel responses increased as a result of IF
- Effect was limited to previously untaught categories for one participant, and to previously mastered categories for the other

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

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Teaching Conversation Skills

Conversation involves complex verbal interchanges between speaker and listener.

Individuals diagnosed with ASD may present with difficulties in this area in spite of fluent verbal repertoires; for example

- Initiating conversation
- Responding appropriately to conversation initiations
- Sensitivity to conversation partners' interests

Recent research on teaching conversation skills

Conallen, K., & Reed, P. (2017). Children with autism spectrum disorder: Teaching conversation involving feelings about events. *Journal of Intellectual Disability Research*, 61, 279-291.

Lepper, T. L., Devine, B., & **Petursdottir, A. I.** (2017). Application of a lag contingency to reduce perseveration on circumscribed interests. *Developmental Neurorehabilitation*, *20,* 313-316.

Mason, L. L., Davis, D., & Andrews, A. (2015). Token reinforcement of verbal responses controlled by temporally removed verbal stimuli. *The Analysis of Verbal Behavior*, 31(1), 145-152. doi:10.1007/s40616-015-0032-4

Peters, L. C., & Thompson, R. H. (2015). Teaching children with autism to respond to conversation partners' interest. *Journal of Applied Behavior Analysis, 48*, 544-562.

Peters & Thompson (2015)

Some individuals with autism are easily engaged in conversation but tend to perseverate on conversation topics that do not interest their listeners

- E.g., circumscribed interests (Klin, Danovitch, Merz, & Volkmar, 2007).

The goal of this study was to teach children to respond appropriately to their conversation partner's interest in the conversation

Peters & Thompson (2015)

10 children (5-9 years) diagnosed with ASD participated in two experiments

Participants were first taught to tact "interested" and "uninterested" listener behavior based on facial expressions and body posture

Participants in Experiment 1 were next taught to respond to an uninterested listener by asking the listener a question, using Behavioral Skills Training

Participants in Experiment 2 were additionally taught to respond by changing the conversation topic

Peters & Thompson (2015)

Conversation probes (up to 15 min):

- Experimenter initiated with an open-ended question (e.g., "What have you been up to?")
- Experimenter engaged as an interested listener by asking and answering questions and commenting
- Experimenter behaved as an uninterested listener for up to 10 s at a time in response to certain participant behavior, for example
  - speaking for a long time without letting experimenter speak
  - providing excessive detail
  - reintroducing a topic already exhausted in the conversation
- Experimenter began to behave as interested again if participant responded appropriately to disinterest
- Ended after 5 opportunities to respond to uninterested listener

Peters & Thompson (2015)

FIGURE

Peters & Thompson (2015)

FIGURE

Peters & Thompson (2015)

All participants acquired the target tacts, but this was not sufficient to alter their responses to a disinterested listener

All participants successfully learned to respond to disinterest when this was directly taught

In Experiment 3, four participants from Experiment 2 were successfully taught to switch to the alternative strategy (asking a question or changing the topic) if the first strategy failed to re-engage the listener

Blind raters watched pre- and posttraining videos from conversation probes procedures and found differences in the quality of conversation

Other Studies

Lepper et al. (2017) used lag reinforcement contingencies to shift two older children's (11-12 years) conversation topics away from perseveration on circumscribed interests (CIs)

- A functional analysis demonstrated sensitivity of conversation to attention as a consequence
- All participants had several CIs that dominated conversation with experimenter in baseline, when attention was provided at the end of every 10-s interval in which the participant talked
- Attention was provided at the end of intervals in which the participant made statements related to a non-recent topic (Lag 1 or Lag 2 contingency), regardless of whether it was a CI topic or not
- Both participants increased CI-unrelated and decreased CI-related talk

Other Studies

Conallen and Reed (2017) successfully taught children to initiate conversation by describing their feelings about an activity or an event (e.g., "I like coloring"), using PECS

Mason et al. (2015) taught one child and two adolescents with ASD to ask questions of previously unknown visitors and report information about the visitor back to another person who inquired about the visitor

Studies Identified

TOTAL OF 70 ARTICLES!

Themes:

1. Establishing functional vocalizations and improving echoic repertoires (3)
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The PEAK® Curriculum

Developed by Mark Dixon (see www.peakaba.com)

"The PEAK Relational Training System is an evaluation and curriculum guide for teaching basic and advanced language skills from a contemporary behavior analytic approach" (www.peakaba.com)

Four modules:

- Direct Training
- Generalization
- Equivalence
- Transformation

Recent research on the PEAK® curriculum

Belisle, J., Dixon, M. R., Stanley, C. R., Munoz, B., & Daar, J. H. (2016). Teaching foundational perspective-taking skills to children with autism using the PEAK-T curriculum: Single-reversal 'I–YOU' deictic frames. *Journal of Applied Behavior Analysis, 49*(4), 965-969. doi:10.1002/jaba.324

Daar, J. H., Negrelli, S., & Dixon, M. R. (2015). Derived emergence of wh question–answers in children with autism. *Research in Autism Spectrum Disorders*, doi:10.1016/j.rasd.2015.06.004

Dixon, M. R., Belisle, J., Rowsey, K. E., Speelman, R. C., Stanley, C. R., & Kime, D. (2017). Evaluating emergent naming relations through representational drawing in individuals with developmental disabilities using the PEAK-E curriculum. *Behavior Analysis: Research And Practice, 17*(1), 92-97. doi:10.1037/bar0000055

Dixon, M. R., Belisle, J., Stanley, C. R., Daar, J. H., & Williams, L. A. (2016). Derived equivalence relations of geometry skills in students with autism: An application of the PEAK-E curriculum. *The Analysis of Verbal Behavior, 32*(1), 38-45. doi:10.1007/s40616-016-0051-9

Dixon, M. R., Belisle, J., Stanley, C. R., Munoz, B. E., & Speelman, R. C. (2017). Establishing derived coordinated symmetrical and transitive gustatory-visual-auditory relations in children with autism and related intellectual disabilities using the PEAK-E curriculum. *Journal of Contextual Behavioral Science, 6*(1), 91-95. doi:10.1016/j.jcbs.2016.11.001

Dixon, M. R., Belisle, J., Stanley, C. R., Speelman, R. C., Rowsey, K. E., Kime, D., & Daar, J. H. (2017). Establishing derived categorical responding in children with disabilities using the PEAK-E curriculum. *Journal of Applied Behavior Analysis, 50*(1), 134-145. doi:10.1002/jaba.355

Dixon, M. R., Peach, J., Daar, J. H., & Penrod, C. (2017). Teaching complex verbal operants to children with autism and establishing generalization using the peak curriculum. *Journal of Applied Behavior Analysis, 50*(2), 317-331. doi:10.1002/jaba.373

Recent research on the PEAK® curriculum

Dixon, M. R., Rowsey, K. E., Gunnarsson, K. F., Belisle, J., Stanley, C. R., & Daar, J. H. (2017). Normative sample of the PEAK relational training system: Generalization module with comparison to individuals with autism. *Journal of Behavioral Education, 26*(1), 101-122. doi:10.1007/s10864-016-9261-4

Dixon, M. R., Speelman, R. C., Rowsey, K. E., & Belisle, J. (2016). Derived rule-following and transformations of stimulus function in a children's game: An application of PEAK-E with children with developmental disabilities. *Journal of Contextual Behavioral Science, 5*(3), 186-192. doi:10.1016/j.jcbs.2016.05.002

Dixon, M. R., Stanley, C. R., Belisle, J., & Rowsey, K. E. (2016). The test-retest and interrater reliability of the Promoting the Emergence of Advanced Knowledge-Direct Training assessment for use with individuals with autism and related disabilities. *Behavior Analysis: Research And Practice, 16*(1), 34-40. doi:10.1037/bar0000027

Malkin, A., Dixon, M. R., Speelman, R. C., & Luke, N. (2017). Evaluating the relationships between the PEAK Relational Training System—Direct Training Module, Assessment of Basic Language and Learning Skills—Revised, and the Vineland Adaptive Behavior Scales—II. *Journal of Developmental And Physical Disabilities, 29*(2), 341-351. doi:10.1007/s10882-016-9527-8

McKeel, A. N., Dixon, M. R., Daar, J. H., Rowsey, K. E., & Szekely, S. (2015). Evaluating the Efficacy of the PEAK Relational Training System Using a Randomized Controlled Trial of Children with Autism. *Journal of Behavioral Education, 24*, 230-241.

McKeel, A. N., Rowsey, K. E., Belisle, J., Dixon, M. R., & Szekely, S. (2015). Teaching complex verbal operants with the PEAK relational training system. *Behavior Analysis in Practice, 8*(2), 241-244. doi:10.1007/s40617-015-0067-y

Rowsey, K. E., Belisle, J., Stanley, C. R., Daar, J. H., & Dixon, M. R. (2017). Principal component analysis of the PEAK generalization module. *Journal of Developmental And Physical Disabilities, 29*(3), 489-501. doi:10.1007/s10882-017-9539-z

Dixon et al. (2017)

PEAK-E curricular program 14B: "Equivalence: Categories with Lag"

- Participants were school-age children (8-9 years) diagnosed with ASD who did not perform correctly on this item in the PEAK-E assessment

Program involved teaching participants to

- match visual stimuli belonging to the same category (e.g., colors; math symbols; musical notes)
- respond as listener to each verbal category label (e.g., "Which is a math symbol?") by selecting a category member (taught with only one member of each category)

Categorization probes assessed listener responses to category labels with all stimuli

Intraverbal probes assessed responses to questions about category members, such as "What is an example of a color?"

Dixon et al. (2017)

FIGURE

Dixon et al. (2017)

FIGURE

Dixon et al. (2017)

FIGURE

Other Studies

McKeel et al. (2015) conducted a randomized controlled trial with 27 participants (age, 5-19 years) to evaluate effects of instruction using the PEAK-DT module

- Treatment group received instruction on five programs from the PEAK-DT module, while control group received standard special education
- Treatment group showed significant pre-post gains on PEAK-DT assessment; control group did not improve
  - Gains were not influenced by pretest scores, or by standard language assessment scores
- Did not assess effect on other measures

Other Studies

Eight additional studies evaluated other programs in the PEAK curriculum and produced positive results.

Four studies obtained normative data or evaluated psychometric properties of the PEAK system.

A great resource you should know about. . .

Analysis Verbal Behav (2017) 33:158–174
DOI 10.1007/s40616-017-0082-x

DISCUSSION/REVIEW ARTICLE

An annotated bibliography of verbal behavior articles published outside of *The Analysis of Verbal Behavior:* 2016

Sarah A. Lechago[1] · Rachel E. Jackson[1] · Fernanda S. Oda[1]

Other References Cited

- Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis*, **35**, 213–231. doi: 10.1901/jaba.2002.35-213
- Esch, B. E., Carr, J. E., & Grow, L. L. (2009). Evaluation of an enhanced stimulus-stimulus pairing procedure to increase early vocalizations of children with autism. *Journal of Applied Behavior Analysis, 42,* 225-241.
- Ganz, J. B., & Simpson, R. L. (2004). Effects on communicative requesting and speech development of the picture exchange communication system in children with characteristics of autism. *Journal of Autism and Developmental Disorders*, **34**, 395–409. doi: 10.1023/b:jadd.0000037416.59095.d7
- Gast, D. L. , Doyle, P. M. , Wolery, M. , Ault, M. J. , & Kolenda, J. L. (1994). Instructive feedback: Effects of number and type. *Journal of Behavioral Education* , **4**, 313-334.
- Greenberg, A. L., Tomaino, M. E., & Charlop, M. H. (2014). Adapting the picture exchange communication system to elicit vocalizations in children with autism. *Journal of Developmental and Physical Disabilities*, **26**, 35–51. doi: 10.1007/s10882-013-9344-2
- Ingvarsson, E. T., & Hollobaugh, T. (2010). Acquisition of intraverbal behavior: Teaching children with autism to mand for answers to questions. *Journal of Applied Behavior Analysis, 43*, 1-17.
- Klin, A., Danovitch, J. H., Merz, A. B., & Volkmar, F. R. (2007). Circumscribed interests in higher functioning individuals with autism-spectrum disorders: An exploratory study. *Research & Practice for People with Severe Developmental Disabilities, 32*, 89-100.
- Koehler-Platten, K., Grow, L. L., Schulze, K. A., & Bertone, T. (2013). Using a lag reinforcement schedule to increase phonemic variability in children with autism spectrum disorder. *The Analysis of Verbal Behavior, 29*, 71-83.
- Lovaas, O. I. (2003). *Teaching individuals with developmental delays. Basic intervention techniques*. Austin, TX: PRO-ED.
- Lovaas, O. I., Berberich, J. P., Perloff, B. F., & Schaeffer, B. (1966). Acquisition of imitative speech by schizophrenic children. *Science, 151*, 705-707.
- Petursdottir, A. I., & Devine, B. (under review). The Impact of *Verbal Behavior* on the Scholarly Literature from 2005 to 2016.

Other References Cited

- Plavnick, J. B., & Ferreri, S. J. (2011). Establishing verbal repertoires in children with autism using function-based video modeling. *Journal of Applied Behavior Analysis, 44*, 747-766.
- Reichow, B., & Wolery, M. (2011). Comparison of progressive prompt delay with and without instructive feedback. *Journal of Applied Behavior Analysis*, **44**, 327–340. Sautter, R. A., & LeBlanc, L. A. (2006). Empirical applications of Skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior, 22*, 35-48.
- Shillingsburg, M. A. ,Valentino, A. L. , Bowen, C. N. , Bradley, D. , & Zavatkay, D. (2011). Teaching children with autism to request information. *Research in Autism Spectrum Disorders*, **5**, 670–679. Skinner 1957
- Tiger, J. H., Hanley, G. P., & Heal, N. A. (2006). The effectiveness of and preschoolers' preference for variations of multiple-schedule arrangements. *Journal of Applied Behavior Analysis, 39*, 475-488.
- Tincani, M., Crozier, S., & Alazetta, L. (2006). The Picture Exchange Communication System: Effects of manding and speech development for school-aged children with autism. *Education and Training in Developmental Disabilities, 41*, 177-184.
- Vladescu, J. C., & Kodak, T. M. (2013). Increasing instructional efficiency by presenting additional stimuli in learning trials for children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 46*, 805-816.
- Wolery, M., Doyle, P. M., Ault, M. L., Gast, D. L., Meyer, S., & Stinson, D. (1991). Effects of presenting incidental information in consequent events on future learning. *Journal of Behavioral Education*, **1**, 79–104.