



# REINFORCEMENT

## CHARACTERISTICS OVERVIEW CHART

Verbal Skills	Grade Levels	Cognitive Level	Areas Addressed
<input checked="" type="checkbox"/> Nonverbal <input checked="" type="checkbox"/> Mixed <input checked="" type="checkbox"/> Verbal	<input checked="" type="checkbox"/> PK <input checked="" type="checkbox"/> Elementary <input checked="" type="checkbox"/> Middle/High	<input checked="" type="checkbox"/> Classic <input checked="" type="checkbox"/> High Functioning	<input checked="" type="checkbox"/> (Pre)Academic/Cognitive/Academic <input checked="" type="checkbox"/> Adaptive Behavior/Daily Living <input checked="" type="checkbox"/> Behavior <input checked="" type="checkbox"/> Communication/Speech <input checked="" type="checkbox"/> Social/Emotional

## BRIEF INTRODUCTION

Reinforcement is a process in which a consequence, a reinforcer, is given following a desired behavior to increase the likelihood that the behavior will occur again under similar conditions. Reinforcement is designed to be used systematically and contingently. There are many types of reinforcers; they should be selected based on their reinforcing nature for a given person and situation.

## DESCRIPTION

According to Miller (2006), a reinforcer is any event or stimulus that follows a behavior closely in time and increases the frequency of that behavior. In other words, reinforcement is the procedure of using a reinforcer to increase the rate of a behavior. It is the most important element of most behavior change. It should be noted that activities, foods, or items that are generally considered pleasant or enjoyable by others may not necessarily be reinforcing. That is, what serves as a reinforcer to one person may not be a reinforcer to another.

For example, if a child receives a piece of chocolate when he asks for one and the frequency of “chocolate-requesting behavior” increases, the chocolate can be seen as a reinforcer that reinforces “chocolate-requesting behavior.” On the other hand, if chocolate-requesting behavior does not increase, the chocolate cannot be considered a reinforcer.



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There are generally two types of reinforcement, positive and negative. Positive reinforcement refers to an increase in the future frequency of a behavior due to the addition of a stimulus following an event. For example, a cookie is given to a child (the addition of the stimulus) whenever he sits appropriately, and the frequency of the child's sitting appropriately increases. On the other hand, negative reinforcement refers to an increase in the future frequency of a behavior due to the removal of a stimulus following an event. For example, an annoying song is turned off (removal of the stimulus) whenever the child asks, and the child's asking behavior increases.

It is important to establish how frequently the reinforcement will be provided. Too frequent use of reinforcement may cause the individual to grow tired of the reinforcement and result in a loss of reinforcement effectiveness. Thus, arranging a schedule for when to use reinforcement and how often is critical. In the following, different types of reinforcement schedules are listed.

- *Fixed-ratio schedule.* Reinforcement is delivered after every  $n$ th response (e.g., the child gets a cookie after each 5 name spellings).
- *Fixed-interval schedule.* Reinforcement is delivered for a behavior after a fixed length of time (e.g., the child gets a cookie for the first correct spelling of his name after five minutes have passed since the last reinforcement).
- *Variable-ratio schedule.* Reinforcement is delivered after a variable number of responses (e.g., the child gets a cookie on average every third time he spells his name correctly).
- *Variable-interval schedule.* Reinforcement is delivered after a variable time (e.g., each time the child spells his name correctly, the teacher gives him a cookie).
- *Differential reinforcement of incompatible behavior.* An incompatible response is reinforced to reduce the occurrence of a behavior (e.g., the child gets a cookie whenever he asks instead of screaming).
- *Differential reinforcement of other behavior.* Reinforcement is delivered to any behavior other than the undesired one to reduce a frequent behavior (e.g., the child gets a cookie whenever he uses his hands to do anything other than screaming).



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- *Differential reinforcement of low-rate behavior.* Reinforcement is used to encourage low rates of responding. It is similar to an interval schedule, except that premature responses reset the time required between behaviors (e.g., the child gets a cookie if he asks for it no more than once every 10 minutes; he gets none if he asks more often).
- *Differential reinforcement of high-rate behavior.* Reinforcement is used to increase high rates of responding. It is like an interval schedule, except that a minimum number of responses are required in the interval in order to receive reinforcement (e.g., the child must interact with a peer 10 times within a 10-minute break in order to get a cookie).

Reinforcement is one of the most fundamental and most important principles of applied behavior analysis (ABA). The following strategies are commonly used by teachers in working with children with autism (AU).

- *Behavior contract.* This intervention is widely used to change student behavior. It is a formal written agreement that spells out in detail the expectations of both the student and the teacher in carrying out the intervention plan, making it a useful planning document. Also, because the student usually has input into the conditions that are established within the contract for earning rewards, the student is more likely to be motivated to abide by the terms of the behavior contract.
- *Token economy.* This is a system that emphasizes reinforcing positive behavior by awarding “tokens” for the performance of the desired behavior. In this system, tokens are accumulated and exchanged for a reinforcer. For example, whenever the child spells his name correctly, he earns a token. After the child has collected five tokens, he can exchange them for playing a computer game for 10 minutes.



## STEPS

The following steps are used in reinforcement:

1. *Identify a desired behavior.* Choose an observable and measurable behavior.
2. *Select an effective reinforcer.* Choose a reinforcer or reinforcers by observation, interview, or completing a reinforcer checklist.
3. *Administer reinforcer contingent upon the desired behavior.* Give the reinforcer on a predetermined schedule after the desired behavior occurs.

## BRIEF EXAMPLE

The target behavior for Susan was to learn the alphabet. In the beginning, whenever Susan identified a correct letter, the teacher gave her a small piece of cookie and praised her. Later on, the teacher still praised Susan for every correct response but gave her a small piece of cookie after three correct responses. Gradually, the teacher continued to use verbal praise for every correct response, but gave Susan a small piece of cookie a few times in an unpredictable manner. After a couple of sessions, the teacher only gave Susan verbal praise when she answered correctly.

## SUMMARY

The purpose of using reinforcement is to increase the frequency of a desired behavior occurring again under similar situations. As such, a reinforcer is the consequence of a behavior, leading to future occurrence. Positive reinforcement means the presentation of a consequence increases a behavior whereas negative reinforcement removes a negative stimulus to increase the occurrence of a behavior.



## RESEARCH TABLE

Number of Studies	Ages (year)	Sample Size	Area(s) Addressed	Outcome
79	3 to adult	214	Communication, self-management, social skills/interaction, behavior management, symbol comprehension/expression, communication/speech, food consumption, leisure education, academic, work-related behaviors, play skills, stereotypic behavior	+

## STUDIES CITED IN RESEARCH TABLE

1. Lang, R., Kuriakose, S., Lyons, G., Mulloy, A., Boutot, A., Britt, C., Caruthers, S., Ortega, L., O’Reilly, M., & Lancioni, G. (2011). Use of school recess time in the education and treatment of children with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 5*, 1296-1305.

The school recess is the subject of this collection of fifteen studies comprising 46 students with AU. The purpose of this study was to evaluate the use of the recess period to teach educational, behavioral, and social intervention interventions. Students increased their social competency.

2. Devlin, S., Healy, O., Leader, G., & Hughes, B. M. (2011). Comparison of behavioral intervention and sensory-integration therapy in the treatment of challenging behavior. *Journal of Autism Developmental Disorder, 41*, 1303-1320.

The objective of the current study was to compare the effects of sensory-integration therapy (SIT) and a behavioral intervention on rates of challenging behavior (including self-injurious behavior) in four children diagnosed with Autism Spectrum Disorder. For each participant, results demonstrated that the behavioral intervention was more effective than the sensory integration therapy in the treatment of challenging behavior.

3. Lanovaz, M.J. & Argumedes, M. (2010). Immediate and subsequent effects of differential reinforcement of other behavior and noncontingent matched stimulation on stereotypy. *Behavioral Interventions, 25*, 229-238.



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This study reports the effective reduction of mouthing behavior by a 3-yr old girl with ASD using both a DRO and an NMS procedure. While both procedures were effective, NMS produced larger and more durable reductions in behavior.

4. Lomas, J.E., Fisher, W.W., & Kelley, M.E. (2010). The effects of variable-time delivery of food items and praise on problem behavior reinforced by escape. *Journal of Applied Behavior Analysis, 43*(3), 425-435.

The purpose of this study was to determine if the non-contingent delivery of food and praise during the presentation of demands reduced the rate of problem behavior for three young boys with ASD. A reversal design showed reduced rates of problem behavior only in the intervention conditions for all three participants.

5. Milo, J., Mace, F.C., & Nevin, J.A. (2010). The effects of constant versus varied reinforcers on preference and resistance to change. *Journal of the Experimental Analysis of Behavior, 93*(3), 385-394.

This study reports that 4 boys with ASD all preferred to work for varied reinforcers (a chance to earn one of three preferred items) rather than a single reinforcer, and that providing varied reinforcers led to an increased response rate and increased resistance to distraction versus providing only a single reinforcer.

6. Cox, A. L., Gast, D. L., Luscre, D., & Ayers, K. M. (2009). The effects of weighted vests on appropriate in-seat behaviors of elementary age-students with autism and severe-profound intellectual disabilities. *Focus on Autism and Other Developmental Disabilities, 24*, 17-26.

The purpose of this study was to evaluate the impact of weighted vests on the amount of time three elementary-age students with autism, intellectual disabilities, and sensory processing challenges engaged in appropriate in-seat behavior. Because weighted vests did not have an effect on appropriate in-seat behavior for any participant, a second experiment was conducted. Noncontingent reinforcement (NCR) was assessed and had positive effect on the participants' in-seat behavior.

7. DeLeon, I. G., Frank, M. A., Gregory, M. L., & Allman, M. J. (2009). On the correspondence between preference assessment outcomes and progressive-ratio schedule assessments of stimulus value. *Journal of Applied Behavior Analysis, 42*(3), 729-733.

The current study examined whether stimuli of different preference levels would be associated with different amounts of work. Using a paired-choice preference assessment, stimuli were classified as high, moderate, or low preference for four individuals with developmental disabilities, three of whom had autism (ages, 9, 11, and 16). Higher preference stimuli were more effective than lower preference stimuli.

8. Dozenblat, E., Brown, J. L., Brown, A. K., Reeve, S. A., & Reeve, K. F. (2009). Effects of adjusting DRO schedules on the reduction of stereotypic vocalization in children with



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autism. *Behavioral Interventions*, 24, 1-15.

The current study of three students with autism (ages 9 to 10), examined the extent to which the relationship between inter-response time and differential reward of other behavior (DRO) affected stereotypic behavior. Results of the current study showed DRO use resulted in a decrease of stereotypical vocalization.

9. 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(2), 225-241.

This study sought to determine whether vocalizations could be strengthened through programmed reinforcement. The participant, a 5-year-old boy with autism, showed differential increases of vocal responses that included a reinforcement component.

10. Karsten, A. M., & Carr, J. E. (2009). The effects of differential reinforcement of unprompted responses on the skill acquisition of children with autism. *Journal of Applied Behavior Analysis*, 42(2), 327-334.

The purpose of the investigation was to compare the delivery of high-quality reinforcers exclusively following unprompted responses (differential reinforcement) with the delivery of high-quality reinforcers following both prompted and unprompted responses (nondifferential reinforcement) on the skill acquisition of two children with autism (ages 3 and 5). Results indicated that both were effective teaching procedures, although the differential reinforcement procedure was more reliable in producing skill acquisition.

11. Schrandt, J., Townsend, D. B., & Poulson, C. L. (2009). Teaching empathy skills to children with autism. *Journal of Applied Behavior Analysis*, 42(1), 17-32.

The purpose of this study was to teach empathetic responding to 4 children with autism (ages 4 to 8). Instructors presented vignettes with dolls and puppets demonstrating various types of affect and used prompt delay, modeling, manual prompts, and reinforcement to teach participants to perform empathy responses. Increases in empathetic responding occurred systematically with the introduction of treatment across all participants. Furthermore, responding generalized from training to non-training stimuli for all participants. Generalization occurred from dolls and puppets to actual people in a non-training setting for two participants.

12. Sigafoos, J., Green, V. A., Payne, D., O'Reilly, M. F., & Lancioni, G. E. (2009). A classroom-based antecedent intervention reduces obsessive-repetitive behavior in an adolescent with autism. *Clinical Case Studies*, 8, 3-13.

The constant rearrangement of objects by a 15-year-old boy with autism interfered with his participation in classroom activities. This behavior was successfully reduced by providing differential reinforcement of incompatible behavior (DRI). Although the treatment was generally successful, follow-up data indicated limited maintenance.



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13. Tiger, J. H., Fisher, W. W., & Boussein, K. J. (2009). Therapist- and self-monitored DRO contingencies as a treatment for the self-injurious skin picking of a young man with Asperger Syndrome. *Journal of Applied Behavior Analysis, 42*(2), 315-319.  
The current study evaluates the effectiveness of differential reward of other behavior (DRO) in the treatment of self-injury (skin picking) in a 19-year-old when implemented first by the therapist and subsequently self-monitored by the client. Therapist- and self-monitored DRO was effective and the self-monitoring was generalized to a novel setting.
14. Waters, M. B., Lerman, D. C., & Hovanetz, A. N. (2009). Separate and combined effects of visual schedules and extinction plus differential reinforcement on problem behavior occasioned by transitions. *Journal of Applied Behavior Analysis, 42*, 309-313.  
The separate and combined effects of visual schedules and extinction plus differential reinforcement of other behavior (DRO) were evaluated to decrease transition-related problem behavior of two 6-year-old boys with autism. Visual schedules alone were ineffective in reducing problem behavior when transitioning from preferred to nonpreferred activities. Problem behavior decreased for both participants when extinction and DRO were introduced, regardless of whether visual schedules were also used.
15. Stephens, C. E. (2008). Spontaneous imitation by children with autism during a repetitive musical play routine. *Autism, 12*, 645-675.  
This study established a musical social milieu using repetitive imitation routines for four children (ages 5- to 8-years-old) with autism. Children increased spontaneous imitation of the researcher's models after being imitated with only social reinforcement.
16. Chung, K., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tassé, M. J. (2007). Peer-mediated social skills training program for young children with high-functioning autism. *Research in Developmental Disabilities, 28*, 423-436.  
The study evaluated the effectiveness of a peer-mediated social skills training program combined with video feedback, positive reinforcement, and token system in increasing social communication in four boys with high-functioning autism. Improvement was observed in three of the four children. Thus, the results revealed that social skills training was effective in improving social communication skills for some children with high-functioning autism.
17. Smaby, K., MacDonald, R.P.F., Ahearn, W. H., & Dube, W. V. (2007). Assessment protocol for identifying preferred social consequences. *Behavioral Interventions, 22*, 311-318.  
The study described a method for rapidly identifying social reinforcers and assessing relative preference among social consequence for young children with autism. The free-operant behavior of three children with autism was analyzed in three social consequence conditions that alternated with an extinction condition. The results identified social consequences that functioned as reinforcers and others to which the child was relatively indifferent.





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18. Drager, K.D.R., Postal, V. J., Carrolus, L., Castellano, M., Gagliano, C., & Glynn, J. (2006). The effect of aided language modeling on symbol comprehension and production in two preschoolers with autism. *American Journal of Speech-Language Pathology, 15*, 112-125.  
The study examined the effectiveness of aided language modeling on the symbol comprehension and expression of two preschool children with autism who used few words functionally. Aided language modeling consisted of engaging the child in interactive play activities and providing models of the use of augmentative and alternative communication symbols during play. Results indicated that both participants demonstrated increased symbol comprehension and elicited symbol production. Thus, the study presented preliminary evidence that a modeling intervention may be effective in increasing symbol comprehension and production and may be an appropriate intervention strategy for some preschoolers with autism.
19. Shabani, D., & Fisher, W. (2006). Stimulus fading and differential reinforcement for the treatment of needle phobia in a youth with autism. *Journal of Applied Behavior Analysis, 39*, 449-452.  
In this investigation, stimulus fading plus differential reinforcement was applied with an 18-year-old adolescent with autism and diabetes whose needle phobia had prevented medical monitoring of his blood glucose levels for over two years. Results showed that the treatment was successful in obtaining daily blood samples for measuring glucose levels.
20. Esch, B. E., Carr, J. E., & Michael, J. (2005). Evaluating stimulus-stimulus pairing and direct reinforcement in the establishment of an echoic repertoire of children diagnosed with autism. *Analysis of Verbal Behavior, 21*, 43-58.  
Three experiments were conducted to evaluate the effect of stimulus-stimulus pairing and direct reinforcement on establishing of an echoic repertoire of children with autism. In Experiment 1, directly reinforced echoic responses did not increase following stimulus-stimulus pairings in three children with autism. Similarly, pairings did not increase free-operant vocalizations in Experiment 2. Experiment 3 demonstrated that shaping increased vowel frequency for one participant. Together, results suggested that the variables are yet to be delineated that influence the effectiveness of stimulus-stimulus pairing procedures on vocalization frequency and acquisition of a verbal operant following such pairings.
21. Grindle, C. F., & Remington, B. (2005). Teaching children with autism when reward is delayed: The effects of two kinds of marking stimuli. *Journal of Autism and Developmental Disorders, 35*, 839-850.  
Three children with autism were taught to identify pictures of emotions in response to their spoken names. In the marked-before condition, an instruction encouraged the children to visually orient to the cards before they made their choice response; in the marked-after condition, an attention-eliciting verbal cue (e.g., "Look!") was delivered after both correct and incorrect responses; in the delay condition, these marking cues were omitted. Results showed



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that performance in the no-cue control was inferior to both the marked-before and marked-after conditions, but the difference between the latter two conditions was not significant.

22. Martin, C. A., Drasgow, E., Halle, J. W., & Brucker, J. M. (2005). Teaching a child with autism and severe language delays to reject: Direct and indirect effects of functional communication training. *Educational Psychology, 25*, 287-304.  
The study examined the effects of direct functional communication training involving prompting, differential reinforcement, and error correction procedures in teaching a 10-year-old child with autism to reject items by touching an icon. Results indicated that the training was successful at replacing pushing away with touching an icon to reject items, but it had variable effects on the other behaviors serving a rejecting function.
23. Taylor, B., Hoch, H., & Weissman, M. (2005). The analysis and treatment of vocal stereotypy in a child with autism. *Behavioral Interventions, 20*, 239-253.  
This study examined procedures for the assessment and treatment of automatically reinforced vocal stereotypy of a 6-year-old girl with autism (IQ 79). A direct reinforcement of other behavior (DRO) schedule led to a reduction in the target behavior during treatment sessions and across the school day.
24. Lerman, D. C., Vorndran, C., Addison, L., & Kuhn, S. A. C. (2004). A rapid assessment of skills in young children with autism. *Journal of Applied Behavior Analysis, 37*, 11-26.  
The relative efficacy of two assessment packages, one containing several reinforcement procedures and the other containing several potentially effective prompts, was evaluated across two to three skills for six children with autism. Results suggested that the methodology was useful for matching targeted skills to appropriate interventions.
25. LeBlanc, L. A., Coates, A. M., Daneshvar, S., Charlop-Christy, M. H., Morris, C., & Lancaster, B. M. (2003). Using video modeling and reinforcement to teach perspective-taking skills to children with autism. *Journal of Applied Behavior Analysis, 36*, 253-257.  
The study used video modeling and reinforcement to teach perspective-taking skills to three children with autism. The training phase included (a) reviewing adult modeling of task completion and (b) providing reinforcers such as verbal praise, preferred edible items, and stickers. Results showed video modeling with reinforcement was effective for teaching perspective-taking skills.
26. Pelios, L. V., MacDuff, G. S., & Axelrod, S. (2003). The effects of a treatment package in establishing independent academic work skills in children with autism. *Education & Treatment of Children, 26*, 1-21.  
The study evaluated the effectiveness of a treatment package in producing independent work by three children with autism with minimal supervision by an adult. The package included (a) delayed reinforcement for on-task and on-schedule responding, (b) fading of instructional prompts and of



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the instructor's presence, (c) unpredictable supervision, and (d) response cost for off-task responding. Results indicated increased levels of on-task and on-schedule responding during treatment for all three children with a supervising adult only occasionally present. Two children required minimal adult supervision in maintenance. Behaviors of all three children generalized.

27. Higbee, T. S., Carr, J. E., Patel, M. R. (2002). The effects of interpolated reinforcement on resistance to extinction in children diagnosed with autism: A preliminary investigation. *Research in Developmental Disabilities, 23*, 61-78.

In the present study, extinction was examined in four young children with autism (ages 4 to 6) were taught sock sorting using intermittent and continuous reinforcement. Extinction occurred more quickly when intermittent reinforcement was used.

28. Lee, R., McComas, J. J., & Jawor, J. (2002). The effects of differential and lag reinforcement schedules on varied verbal responding by individuals with autism. *Journal of Applied Behavior Analysis, 35*, 391-402.

The purpose of the present study was to investigate the effects of a lag schedule of differential reinforcement on varied and appropriate verbal responding to social questions by 3 males with autism (two were 7 years of age and one was 27 years of age). During baseline, differential reinforcement of appropriate responding (DRA) resulted in little or no varied responding. When a lag requirement was added to the DRA an increase in the varied and appropriate verbal responding occurred for two of the three participants.

29. Ringdahl, D. E., Kitsukawa, K., Andelman, M. S., Call, N., Winborn, L., Barretto, A., & Reed, G. K. (2002). Differential reinforcement with and without instructional fading. *Journal of Applied Behavior Analysis, 35*, 291-294.

An 8-year-old girl participated in the study, which evaluated a differential-reinforcement-based treatment package for reducing problem behavior during instructional situations. Results indicated that differential reinforcement of alternative behavior with instructional fading resulted in less problem behavior than when used without instructional fading.

30. Adelinis, J., Piazza, C., & Han-Leong, G. (2001). Treatment of multiply controlled destructive behavior with food reinforcement. *Journal of Applied Behavior Analysis, 34*, 97-100.

We evaluated the extent to which the positive reinforcement of communication would reduce destructive behavior in the absence of relevant extinction components. When edible reinforcement for appropriate communication and nonfood reinforcers for problem behavior were available simultaneously to a 12-year-old boy with autism, he responded in the manner that produced edible reinforcement.

31. DeLeon, I., Neidert, P. L., Anders, B. M., & Rodriguez-Catter, V. (2001). Choices between positive and negative reinforcement during treatment for escape-maintained behavior. *Journal of Applied Behavior Analysis, 34*, 521-525.



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The study demonstrated the effectiveness of positive reinforcement in the treatment of escape-maintained behavior of a child with autism. Results indicated that positive reinforcement was more effective for compliance under dense reinforcement schedules.

32. Dixon, M. R., & Cummings, A. (2001). Self-control in children with autism: Response allocation during delays to reinforcement. *Journal of Applied Behavior Analysis, 34*, 491-495.

The study examined the use of a progressive delay schedule of reinforcement to increase self-control and decrease disruptive behavior in three children with autism. Results indicated that self-control was increased by progressively delaying access to a larger reinforcer and choice of activities.

33. Ringdahl, J. E., Vollmer, T. R., Borrero, J. C., & Connell, J. E. (2001). Fixed-time schedule effects as a function of baseline reinforcement rate. *Journal of Applied Behavior Analysis, 34*, 1-15.

The authors evaluated fixed-time (FT) schedules that were either similar or dissimilar to a baseline reinforcement schedule and extinction. Results suggested that both schedules and extinction resulted in decreased responding in two individuals with autism spectrum disorders (ages 4, 5) However, reinforcement was more effective in reducing response rates if the reinforcer rate was dissimilar to baseline reinforcer rates.

34. Hagopian, L. P., Crockett, J. L., van Stone, M., DeLeon, I. G., & Bowman, L. G. (2000). Effects of noncontingent reinforcement on problem behavior and stimulus engagement: The role of satiation, extinction, and alternative reinforcement. *Journal of Applied Behavior Analysis, 33*, 443-448.

Four individuals participated in the study, which examined the effects of noncontingent reinforcement with and without extinction on problem behavior and stimulus engagement. Results showed that noncontingent reinforcement without extinction can be effective in reducing problem behavior if the alternative sources of free reinforcement are adequately dense.

35. McComas, J., Hoch, H., Paone, D., & El-Roy, D. (2000). Escape behavior during academic tasks: A preliminary analysis of idiosyncratic establishing operation. *Journal of Applied Behavior Analysis, 33*, 479-493.

Three boys with developmental disabilities and autism participated in a study that evaluated the effects of idiosyncratic features of academic task demands and related methods of instruction on the occurrence of negatively reinforced destructive behavior. Results suggested that the effect of idiosyncratic features of academic task demands can be experimentally isolated from the effects of consequences of responding.

36. Callahan, K., & Rademacher, J. A. (1999). Using self-management strategies to increase the on-task behavior of a student with autism. *Journal of Positive Behavior Interventions, 1*, 117-122.



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The study evaluated the effectiveness of using self-management strategies and reinforcement to increase the on-task behavior of a second-grade student with autism. Data indicated that the rate of on-task behavior was significantly increased when self-management and reinforcement procedures were implemented. In addition, improvements in independent academic and behavioral functioning were also documented.

37. Richman, D. M., Wacker, D. P., Asmus, J. M., Casey, S. D., & Andelman, M. (1999). Further analysis of problem behavior in response class hierarchies. *Journal of Applied Behavior Analysis, 32*, 269-283.  
A functional analysis identified the reinforcers for two participants' problem behavior (8-years old with ADHD, mental retardation and autism; 4-year-old with DD and ASD) who had mild problem behaviors. Extinction was used which confirmed that the same reinforcer identified in the initial functional analysis maintained more severe topographies of problem behavior (e.g., aggression).
38. Buffington, D. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1998). Procedures for teaching appropriate gestural communication skills to children with autism. *Journal of Autism and Developmental Disorders, 28*, 535-545.  
Four children with autism were taught to use gestures in combination with oral communication. None of the participants displayed appropriate gestural and verbal responses during baseline; however, they all acquired this skill with the systematic implementation of modeling, prompting, and reinforcement. The skills learned were also generalized.
39. Freeman, K. A., & Piazza, C. C. (1998). Combining stimulus fading, reinforcement, and extinction to treat food refusal. *Journal of Applied Behavior Analysis, 31*, 691-694.  
The study combined fading, reinforcement, and escape extinction using guided compliance to increase food consumption while maintaining low rates of disruptive behavior at mealtime for a 6-year-old girl with autism. Results indicated that intake increased and compliance with prompting procedures remained relatively stable despite the requirement to increase consumption.
40. Mace, A.B.M., Shapiro, E. S., & Mace, F. C. (1998). Effects of warning stimuli for reinforcer withdrawal and task onset on self-injury. *Journal of Applied Behavior Analysis, 31*, 679-682.  
A 7-year-old girl with autism participated in the study, which investigated the effects on self-injury of warning stimuli for reinforcer withdrawal and task onset. Results of a functional analysis of self-injurious behavior showed that the child's behavior was maintained by access to preferred objects and escape or avoidance of task demands. Extinction and noncontingent reinforcement treatments were supplemented by presenting a statement combined with a picture cue at 30-second intervals, indicating that a preferred object would be removed or a task would be presented. Results showed that warning stimuli in combination with extinction and noncontingent reinforcement reduced self-injurious behavior to acceptable levels. In addition,



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the frequency of self-injurious behaviors remained comparatively high in a control condition consisting of a 2-minute-delay of onset of reinforcer removal or task demands.

41. Newman, B., Tuntigian, L., Ryan, C. S., & Reinecke, D. R. (1997). Self-management of a DRO procedure by three students with autism. *Behavioral Interventions, 12*,149-156.  
Three students with autism (ages 4, 6, and 12) were taught to self-manage a differential reward of other behavior (DRO) program to reduce their disruptive behavior (either out-of-seat or nail-flicking). Students were taught to self-manage a DRO program during external reinforcement and prompted self-management conditions. Student gains were maintained during unprompted self-management and follow-up conditions.
42. Piazza, C. C., Moes, D. R., & Fisher, W. W. (1996). Differential reinforcement of alternative behavior and demand fading in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis, 29*, 569-572.  
The study showed that the escape-maintained destructive behavior of an 11-year-old boy with autism was reduced during instructional sequences using differential reinforcement of compliance, escape extinction without physical guidance, and demand fading. Specifically, the procedure decreased destructive behaviors to near-zero levels and greatly increased compliance.
43. Lalli, J. S., Mace, F. C., Wohn, T., & Livezey, K. (1995). Identification and modification of a response-class hierarchy. *Journal of Applied Behavior Analysis, 28*, 551-559.  
The study evaluated the effects of extinction and negative reinforcement on the latency of response-class members following requests made to a 15-year-old female with moderate mental retardation and autism. Results showed that the latencies occurred in a predictable order. In addition, the response class was expanded to include an appropriate vocal response that was functionally equivalent to others.
44. Strain, P. S., Kohler, F. W., Storey, K., & Danko, C. D. (1994). Teaching preschoolers with autism to self-monitor their social interactions: An analysis of results in home and school settings. *Journal of Emotional and Behavioral Disorders, 2*, 78-88.  
Three preschool boys with autism participated in the study, which examined the effects of a self-monitoring intervention. Three primary results were obtained: (a) the self-monitoring package increased each participant's interactions with his peers and/or siblings; (b) the school and home procedures produced comparable impacts on some dimensions of children's social behaviors, but other outcomes were affected differentially; and (c) both adult prompts and reinforcement were successfully reduced or faded within the school and home intervention settings.
45. Rigsby-Eldredge, M., & McLaughlin, T. F. (1992). The effects of modeling and praise on self-initiated behavior across settings with two adolescent students with autism. *Journal of Developmental and Physical Disabilities, 4*, 205-218.



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The study examined whether modeling and verbal reinforcement (praise) could increase appropriate social and work-related behaviors of two 20-year-old males with autism. The effects of modeling and praise were examined in school, work, and community environments. Overall, modeling and praise were effective in increasing each participant's appropriate social and work-related behaviors. Questionnaires administered to teachers, a job trainer, a communication disorder specialist, paraprofessionals, coworkers, and parents indicated positive change in each participant's behavior.

46. Carr, E. G., & Kemp, D. C. (1989). Functional equivalence of autistic leading and pointing: Analysis and treatment. *Journal of Autism and Developmental Disorders, 19*, 561-578.  
A less desirable form of requesting, leading, was treated by strengthening a more desirable form of requesting, pointing. The study was conducted with 4 children (aged 3 and 5 yrs) with autism. Intervention included verbal and physical prompting of the pointing response as well as tangible reinforcement for child-initiated instances of that response. Verbal requesting was also taught to accompany the pointing. Following intervention, generalization was observed.
47. Handler, M., Weisberg, P., & O'Dell, N. (1987). Developing the receptive and productive use of pronouns in an autistic child: Use of modeling and programming for generalization. *Child & Family Behavior Therapy, 9*, 17-34.  
The study trained a 4-year-old boy to answer "my-your" questions when reinforced for modeling an adult's answers to questions about possessive pronouns. Modeling and reinforcement training procedures improved the receptive use of "my-your" performance; nevertheless, generalization probes revealed no receptive transfer. The same procedure also improved the expressive use of "his-her" answers, and immediate generalization of training for "his-her" occurred at the expressive and receptive levels.
48. Handen, B. L., Apolito, P. M., & Seltzer, G. B. (1984). Use of differential reinforcement of low rates of behavior to decrease repetitive speech in an autistic adolescent. *Journal of Behavior Therapy and Experimental Psychiatry, 15*, 359-364.  
The study demonstrated how a differential reinforcement of low rates schedule successfully reduced repetitive speech in a 16-year-old adolescent with autism. The rate of repetitions was reduced using tokens for maintaining rates of repetitive speech. A phase in which the token economy was no longer in effect resulted in a return to baseline. However, when the tokens were reintroduced, repetitive speech decreased. These results were maintained at 6- and 14-month follow-up.
49. Hawkins, A. H. (1982). Influencing leisure choices of autistic-like children. *Journal of Autism and Developmental Disorders, 12*, 359-366.  
A leisure education program was implemented with three boys with autistic-like behaviors. Three alternating conditions (prompt and praise condition, praise anything condition, and token



economy condition) were used to encourage participation in low-interest recreational activities. Results showed that the prompt and praise condition was superior to the other two conditions in encouraging participation in low-interest recreational activities.

50. Wehman, P., & Marchant, J. A. (1978). Improving free play skills of severely retarded children. *American Journal of Occupational Therapy, 32*, 100-104.

The study examined the effects of a behavioral training program on the autistic-like, independent, and social play of four children with intellectual disabilities. The training program involved the use of instructions, modeling, physical guidance, and verbal reinforcement. Results indicated a marked increase in independent and social play with the introduction of the training program with all four children.

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## ORGANIZATIONS RECOGNIZING INTERVENTION AS EVIDENCE BASED

Centers for Medicaid and Medicare Services

National Autism Center

National Professional Development Center

## RESOURCES AND MATERIALS

- Autism Internet Modules. Differential Reinforce Module and Reinforcement Module: <http://www.autisminternetmodules.org/>
- National Professional Development Center on Autism Spectrum Disorders. Evidence Practice Brief: Reinforcement: <http://autismpdc.fpg.unc.edu/content/reinforcement>  
The NPDC has developed evidence-based practice (EBP) briefs for their identified EBP. Each brief contains an overview, step-by-step directions for implementation, implementation checklist, and evidence base.
- Reinforcement Systems. Association for Science in Autism Treatment (ASAT). <http://www.asatonline.org/intervention/procedures/Reinforcement.htm>

## GENERAL RESOURCES

- Autism Internet Modules (AIM) [www.autisminternetmodules.org](http://www.autisminternetmodules.org). The Autism Internet Modules were developed with one aim in mind: to make comprehensive, up-to-date, and usable information on autism accessible and applicable to educators, other professionals, and families who support individuals with autism spectrum disorders (ASD). Written by experts from across the U.S., all online modules are free, and are designed to promote understanding of, respect for, and equality of persons with ASD.
- The Autism Web Course: [http://cdd.unm.edu/swan/autism\\_course/about/index.htm](http://cdd.unm.edu/swan/autism_course/about/index.htm). This web course was developed out of materials from the Interactive Collaborative Autism Network (ICAN). The Autism Programs at the University of New Mexico has updated and added information to this web course.
  - Characteristics
  - Assessment
  - Academic Interventions
  - Behavioral Interventions



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- Communication Interventions
- Environmental Interventions
- Social Interventions
- Family Support Suggestions
  
- Indiana Resource Center for Autism (IRCA)  
<http://www.iidc.indiana.edu/irca/fmain1.html>. The Indiana Resource Center for Autism staff's efforts are focused on providing communities, organizations, agencies, and families with the knowledge and skills to support children and adults in typical early intervention, school, community, work, and home settings.
  - IRCA Articles: <http://www.iidc.indiana.edu/index.php?pageId=273>
  
- Texas Statewide Leadership for Autism [www.txautism.net](http://www.txautism.net). The Texas Statewide Leadership for Autism in conjunction with the network of Texas Education Service center with a grant from the Texas Education Agency has developed a series of free online courses in autism. Please check the training page, [www.txautism.net/training.html](http://www.txautism.net/training.html), for update lists of courses, course numbers and registration information. Current courses include the following:
  - Asperger Syndrome 101
  - Augmentative and Alternative Communication and the Autism Spectrum
  - Autism for the General Education Teacher
  - Autism 101: Top Ten Pieces to the Puzzle
  - Classroom Organization: The Power of Structure for Individuals with ASD
  - Communication: The Power of Communication for Individuals with ASD
  - Futures Planning for Students with Autism Spectrum Disorder
  - Navigating the Social Maze: Supports and Interventions for Individuals with ASD
  - Solving the Behavior Puzzle: Making Connections for Individuals with ASD