Effectiveness of Dolphin-Assisted Therapy as a Behavioral Intervention for Young Children with Disabilities

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This research synthesis focuses on the effectiveness of dolphin-assisted therapy as a behavioral intervention for young children with disabilities. The practice constituting the focus of this synthesis contains the following characteristics: (1) the therapy targets a specific goal for a child with disabilities and (2) the child's correct responses toward achieving the goal are reinforced through direct and/or indirect contact with a dolphin. All studies reviewed in this report failed to adequately control for a number of possible threats to validity or alternative explanations. Therefore, study outcomes could not be conclusively attributed to the intervention. Claims of the effectiveness of using dolphins as a procedure for improving the behaviors of young children with disabilities are therefore not supported by available research evidence.

Purpose

The purpose of this practice-based research synthesis is to investigate the effectiveness of dolphin-assisted therapy for improving the cognitive, physical, or social-emotional behaviors of young children with disabilities. The conduct of this synthesis is guided by a framework developed by Dunst, Trivette, and Cutspec (2002) that focuses on the degree to which similarities in the characteristics of a practice produce the same or similar outcomes. The practice constituting the focus of this research synthesis uses interactions with dolphins as reinforcement for children's correct responses to different kinds of therapeutic tasks.

Background

Dolphin-assisted therapy (DAT) has become an increasingly popular approach to intervention for children with disabilities. The therapy typically occurs in marine parks and dolphinariums as part of programs that allow people to swim with dolphins. Children receiving DAT go through focused one-on-one sessions of individualized activities with a therapist (e.g., a speech, occupational, or physical therapist depending on the child's disability) where interactions with dolphins follow a child's correct cognitive, physical, or social-emotional response. Large numbers of these programs operate in countries throughout the world, including Mexico, the United States, Israel, and Russia. Proponents claim that DAT can effectively improve language, behavior, cognitive processing, attention, motivation to learn, and certain medical conditions (Lukina, 1999; Servais, 1999). Dolphin-assisted therapy programs have received highly favorable notice from the media, including television news programs, adding to its popularity.

The idea that human interaction with dolphins may be beneficial was first formulated in the 1960s by John Lilly, who studied dolphin-human communication and suggested that dolphins could help humans learn to communicate better with one another. Lilly's ideas were extended into the 1970s when dolphin researchers began examining the effects that interacting with dolphins appeared to have on children with neurological impairments (McKinney, Dustin, & Wolff, 2001; Smith, 1983, 1984). However, most of the empirical research on the effectiveness of dolphin-assisted therapy has been conducted in the last decade and has been carried out primarily by those who operate dolphin-assisted therapy programs and other "dolphin-swim" programs.

As the popularity of DAT has grown, claims of its therapeutic benefits have also grown, primarily through anecdotes reported via mainstream media channels. Such reports claim that dolphin-assisted therapy helps children with post-traumatic stress disorder, autism, Down's syndrome, cancer, and other neurological, physical, or psychological conditions. The reports assert that the therapy's success rates for physical or behavioral improvement are as high as 90% (McKinney et al., 2001; Price, 2001). Critics of the therapy suggest that DAT is similar to interactions with domestic animals or to taking a warm bath and, therefore, question the validity of the reported benefits (Condoret, 1983; Marino &

Lilienfeld, 1998; Rossiter, 1998). Further, critics claim that the therapy has potential for causing harm to participants since there have been reports of injuries during dolphin-swim programs (Humane Society of the United States, 2002).

Description of the Practice

Dolphin-assisted therapy is typically practiced under the name Dolphin Human Therapy. The procedure was developed by David Nathanson, a clinical psychologist who has conducted much of the existing research on DAT. Dolphin-assisted therapy is based on Nathanson's theory that children with disabilities will increase their attention to relevant stimuli in the environment as a result of their desire to interact with dolphins. According to Nathanson, the general purpose of the program is to encourage children to engage in desired responses in accordance with the child's individualized therapy program (Nathanson, 1998; Nathanson, de Castro, Friend, & McMahon, 1997; Nathanson & de Faria, 1993). The dolphin- assisted therapy sessions are designed to "jump start" the child and to complement or reinforce other, more traditional, therapeutic procedures (Nathanson, 1998).

DAT consists of defining a treatment goal for the individual child, such as completing a gross or fine motor task (e.g., placing a ring on a peg) or producing a language behavior (e.g., independently saying a word). Materials used as adjuncts to therapy are typically present during a DAT session, including rubber balls or rings for eliciting motor responses, or flash cards depicting objects for language responses. Children receive on-dock orientation to the dolphins, with the child and the child's therapist typically sitting at the edge of a padded floating dock about 2-3 inches above the water, while a dolphin trainer controls the movements of a dolphin in the water. During orientation, children are able to touch or play with the dolphin from the dock or to give hand signals to the dolphin to elicit specific dolphin behaviors.

Following the orientation period, children engage in a series of therapeutic sessions during which they may interact with the dolphin from the dock or in the water after giving a correct motor, cognitive, or language response. Interactions with the dolphins may include touching, kissing, taking a short ride holding onto the dolphin's dorsal fin, or dancing in a circular motion with the dolphin. Following each episode of reinforcement, the child and therapist return to the therapeutic task, often with an increasing frequency and complexity of correct responses required for the child to interact with the dolphin.

Search Strategy

Search Terms

Identification of relevant studies was accomplished using the search terms: dolphin human interaction, dolphin and therapy, dolphin-assisted therapy, dolphin human therapy, cetacean human interaction, and cetacean and therapy. The search was delimited by adding infants, toddlers, or preschool children as a Boolean condition.

Sources

A computer-assisted bibliographic search for studies using the above search terms was conducted in Psychological Abstracts (PsycINFO), Educational Resources Information Center (ERIC) database, Dissertation Abstracts, Health Source: Nursing/Academic Edition, Academic Search Elite, Cumulative Index to Nursing and Allied Health Literature (CINAHL), WorldCat, InfoTrac Expanded Academic ASAP, and MEDLINEplus. A search was also conducted on the World Wide Web using the search engine MSN Search and employing the keyword terms dolphin or cetacean therapy, dolphin or cetacean research, dolphinassisted therapy, dolphin human therapy, and dolphin or cetacean and human interaction. Bibliographies listed on specific websites related to dolphin-assisted therapy (e.g., www.idw.org) were searched also. In addition, reference sections of articles identified through the above means were searched for further relevant studies.

Selection Criteria

To be included in this synthesis, the studies had to meet three criteria: (1) studies had to include children with disabilities six years of age or younger (chronologically or developmentally), (2) the practice characteristics for implementing dolphin-assisted therapy had to be included, and (3) the outcomes of the practice had to be described. Studies involving children with any type of disability were included.

Search Results

Six studies were located that met the selection criteria (Lukina, 1999; Nathanson, 1989, 1998; Nathanson et al., 1997; Nathanson & de Faria, 1993; Servais, 1999). A seventh study (Nathanson, 1980) was excluded because of the lack of specificity regarding both the practice characteristics and

outcomes. Selected characteristics of the study participants are summarized in Table 1. Table 2 shows the research designs and intervention variables used in each study. The table also displays the outcome measures used in the study and measurement of intervention variation, reliability, and validity.

Participants

Information regarding the characteristics of the children who participated in the studies was limited to age range, gender, type of disability, and nationality. A total of 294 children participated in the studies. Exact ages of the children were not always reported, although five studies provided age ranges (for these studies the age range was 2-13 years). A sixth study (Servais, 1999) provided only developmental ages for each child as measured by the Psychoeducational Profile (PEP). The average developmental age for this study was 27 months.

Of the four studies that reported gender, most of the children (64%) were male (Nathanson, 1989; Nathanson et al., 1997; Nathanson & de Faria, 1993; Servais, 1999). Participant samples in most of the studies (N = 5, 83%) were comprised of children whose parents had enrolled them in dolphin-assisted therapy or had inquired about the dolphin- assisted therapy program. One study (Nathanson, 1989) recruited participants from a local support group for parents of children with disabilities.

Four of the studies recruited participants with similar types of disabilities, specifically autism, mental retardation, and "severe disabilities" (Nathanson, 1989; Nathanson et al., 1997; Nathanson & de Faria, 1993; Servais, 1999). The remaining two studies included children with a variety of disabilities within each sample, including children with mental retardation, speech disorders, cerebral palsy, developmental delays, and traumatic brain injury (Lukina, 1999; Nathanson, 1998).

The nationalities of the participants were diverse, including a Ukrainian sample (Lukina, 1999) and a Belgian sample (Servais, 1999). In one study conducted in the United States, there was an international sample of children from Korea, Switzerland, Germany, Ireland, Wales, England, Scotland, and the United States (Nathanson et al., 1997); although the exact numbers and percentages of participating children representing each nation were not reported.

Research Designs

As can be seen in Table 2, the majority of the studies (N = 5, 83%) employed a pretest/posttest research design to assess behavioral or physiological behavior of the children before and after receiving DAT. Two of those studies (Nathanson, 1989; Nathanson & de Faria, 1993) used variations of a reverse-treatment design with a pretest and a posttest. In one of those two studies (Nathanson, 1989), participants received both DAT and a classroom intervention, in counterbalanced order, during every therapy session. A similar design was used in the other study (Nathanson & de Faria, 1993), as participants either received one therapy session consisting first of DAT followed by the use of toys as reinforcers, or they received one therapy session with toys as the reinforcer followed by DAT. Posttests results in both of these studies were obtained by comparing the children's performance during the portion of the sessions that used DAT with their performance in the reversed portion of the sessions (e.g., classroom or toys). One investigator completed a series of two studies, both of which used a pretest/posttest design with a control group (Servais, 1999).

One study (Nathanson, 1998) used a one-group, posttest-only design to assess outcomes of DAT. In that study, parents completed a survey, at least 12 months after their child received one or two weeks of DAT. The survey consisted of 15 behavioral items preceded by the phrase, "As a result of Dolphin Human Therapy, my child has maintained or improved his/her ability to . . ." (Nathanson, 1998, p. 24). The survey asked parents to respond to each item by circling one of six possible responses: never (0% of the time), seldom (25% of the time), often (50% of the time), usually (75% of the time), always (100% of the time), and does not apply.

Practices

Session characteristics. All the investigators indicated the therapy sessions took place using domesticated dolphins kept in enclosed pens or tanks. Four studies (67%) indicated that each child interacted with the same dolphin throughout the sessions. Three studies (50%) reported that the sessions occurred for participants at the same time of day and with the same therapist and dolphin handler.

DAT sessions averaged 30 minutes in five of the studies, with children attending an average of 16 sessions. In one study (Nathanson & de Faria, 1993), DAT was conducted during two sessions that each consisted of 18 task trials. In three studies, the sessions were reported to have occurred during

the summer months with an average water temperature across the studies of 84.6° (Nathanson, 1998; Nathanson et al., 1997; Nathanson & de Faria, 1993).

Therapy tasks and reinforcers. The tasks completed during DAT sessions were described in five studies. In three studies, geometric figures or objects were painted on wooden boards to elicit language (e.g., attempting or approximating the figure's name) or motor responses (e.g., touching an object or placing a ring on a peg). One study (Servais, 1999) used a cognitive task that required children to place foam rubber pieces in the correct places on a board. Two studies did not specifically describe the tasks used during DAT (Lukina, 1999; Nathanson, 1998).

In two studies (34%), reinforcement for participants' correct responses to the tasks was provided using direct interactions with the dolphins (e.g., feeding, touching, or kissing the dolphins). The remaining studies (N = 4, 66%) used a combination of indirect (e.g., waving to the dolphins, observing dolphin tricks) and direct interactions to reinforce correct responses.

Outcomes

The relationships between dolphin-assisted therapy and the participants' behavioral and social-emotional outcomes are provided in Table 3. Potential threats to validity and possible rival hypotheses for the outcomes are also displayed in this table.

The behavioral outcomes that were the focus of investigation included vocalizations or language responses (N = 4, 67%), positive social-emotional responding (N = 2, 34%), cognitive problem solving, increased attention (N = 2, 34%), vocabulary retention (N = 1, 17%), and motor task completion (N = 1, 17%). Two studies (34%) targeted different behaviors for different participants based upon each child's individualized therapy program. In two studies, several social-emotional outcomes were also measured for children receiving DAT (Lukina, 1999; Nathanson, 1998).

Synthesis Findings

Table 3 summarizes the findings from the studies included in this synthesis in terms of targeted behavioral responses and the social-emotional outcomes observed or reported by the investigators. The findings are ones reported by the investigators regarding the benefits of dolphin-assisted therapy. The extent to which the results reported by the authors may be challenged or compromised by rival explanations are listed in the last column of the table.

Results

Behavioral findings. All of the investigators reported improved behavioral outcomes for children receiving DAT, with the exception of Servais (1999), who reported positive outcomes in only one of the two experimental groups included in her study. In the domains of language (e.g., attempts to say words, naming objects, using sign language), cognition (e.g., completing a matching task, vocabulary retention), and motor function (e.g., placing a ring on a peg, independently reaching for an object, writing), children were reported to respond correctly more often when working with the dolphins than in other conditions.

Social-emotional outcomes. Social-emotional outcomes included displays of newly emergent kindness, improved attentiveness, initiating play, maintaining eye contact, and self-control. One study (Lukina, 1999) further reported that the cardiac rhythms of the participants in all categories of disability indicated the "redistribution of psychoemotional dominants" (p. 678), as well as a decrease in the frequency and manifestation of depression, night phobias, hysteria, and enuresis among one group of participants. Although no actual data or description of assessment instruments were provided to support these reported outcomes.

It is important to note that all reported behavioral and social-emotional improvements must be interpreted within the context of the study designs, methods of data collection, and processes of analysis used by the study investigators. The studies included in this synthesis are so plagued with methodological flaws that claims that the reported outcomes are due to dolphin-assisted therapy may be erroneous.

Rival Explanations

Multiple threats to internal and external validity and rival explanations for the reported outcomes are present in all six studies. The major threats and rival explanations are listed in Table 3 and are explained in more detail in the following subsections.

Limited data reported. There was an extremely limited amount of data provided to substantiate the reports of positive child outcomes in several of the studies. For example, the investigators of three studies presented only limited pretest/posttest results, yet they reported having used single-subject designs (Nathanson, 1989; Nathanson et al., 1997; Nathanson & de Faria, 1993). This omission of

any single-subject data renders it impossible to determine whether or not intervention outcomes were replicated across children. Also, despite the fact that four investigators claimed that DAT maintained children's attention, in three of those studies no data was provided, or apparently even collected, that measured attention (Nathanson, 1989, 1998; Nathanson et al., 1997; Nathanson & de Faria, 1993). None of the studies provided data regarding the generalization of effects of DAT over time or across settings.

In the study by Lukina (1999), the fact that she reported many outcomes suggests that she collected a substantial amount of data. However, the data and collection procedures were not described or presented in a useful way. Rather, Lukina only provided pretest/posttest data on cardiac-rhythm variability while reporting several social- emotional and behavioral improvements.

Threats related to research designs. Four studies used a one-group, pretest/posttest, pre-experimental design, and one study used a one-group, posttest-only design, rendering it impossible to conclude that DAT was the cause of the reported outcomes. Since the studies used a one-group design, the possibility that participants' posttest improvements could have been the result of maturation or any other factors that occurred simultaneously with the intervention cannot be ruled out. Several of the studies took place over a period of several months. It is possible that participants in a control group would have shown the same posttest improvement after several months.

Problems with instrumentation threatened the validity of the studies using one-group designs. All but one study appeared to have used different measures to assess posttest performance than were used at the pretest. In addition, none of the measures used to assess outcomes in any of the studies appear to have been standardized, although this fact remains uncertain in one case in which measures used to collect data for almost all results reported were not described at all (Lukina, 1999). Statistical regression is also difficult to rule out as a factor explaining improvements in the one-group-only research designs. All participants received DAT because of their extremely low scores on pretest measures. Such participant selection may have yielded a spurious improvement between the pretest/posttest scores (Kendall, Flannery-Schroeder, & Ford, 1999).

Treatment fidelity is compromised by the methodological flaws contained in several studies. For example, in the one pretest/posttest study that used a control group (Servais, 1999), the investigator stated that the procedures used in the study were not well controlled and that validity was compromised. In that study, compensatory equalization of treatments occurred when the person implementing the control-group procedures appeared to explicitly influence the outcomes. The person wanted to teach the children "as well as the dolphins" (p. 12), and she gave the children the correct answers to the learning task. As a result, Servais concluded that her research cannot be used to establish the efficacy of DAT for children with disabilities.

Other possible threats. All of the studies were subject to investigator bias, since the practitioners and researchers were aware of the anticipated outcomes for the studies. While one study included individuals who were unaware of the research purpose to code the videotaped child behaviors (Nathanson & de Faria, 1993), the practitioner on the videotapes was the principal investigator who was obviously aware of the expected behavioral outcomes. This is a special case of investigator bias, because investigator expectancies may have influenced how the children in the study responded, as well as how the behaviors were interpreted for coding purposes (Rosenthal, 1994). In another study (Servais, 1999), the principal investigator was the only person who coded the videotapes to determine behavioral outcomes, a method that allows for investigator expectancies to influence how behaviors are coded and interpreted (Lukina, 1999; Nathanson, 1989).

Respondent bias was also likely to influence the results in at least one study. It should be noted that all of the participants appear to have been selected for participation in the studies when their parents contacted a DAT program about enrolling and gave consent for their participation. Such convenience sampling increases the likelihood that respondent bias influenced the outcome data, since the parents are likely to have an expectation of improvement and to be aware of a study's purpose. For example, parents who responded to the outcome survey (Nathanson, 1998) were more than likely aware of the survey's purpose, since the phrase to which they responded for all items began with the words, "As a result of Dolphin Human Therapy, my child has maintained or improved . . ." It has been demonstrated that when individuals expect to witness improvements, they often will report the presence of such improvement (Pratkanis, Eskenazi & Greenwald, 1994).

The novelty and excitement of encountering dolphins may also have influenced the children's behavior in every study, because the animals are distinct from the types of animals that most children are likely to encounter in their everyday lives, such as dogs or cats. Multiple-treatment interference may also account for the outcomes reported in the studies, since four of the six studies reported that the participating children also experienced other types of therapy, including pet therapy. Five of the six studies are also flawed by multiple-treatment interference in the sense that they do not attempt to

determine whether the water immersion alone provided therapeutic benefits, as some research suggests (Nathanson & de Faria, 1993; Slade & Simmons-Grab, 1987; Smith, 1983), but only examined the outcomes of dolphins in the water. Given that the therapeutic benefits of water immersion are part of the theory used to justify DAT (Nathanson & de Faria, 1993), this omission seems important.

In addition, due to the lack of experimental controls in the studies, history cannot be ruled out as a factor influencing children's performance, given that the occurrence of other events in addition to the experimental treatment may have influenced the children's behavior in the sessions. This is particularly true in the case of participants who traveled from other geographic areas of the world (Nathanson, 1998; Nathanson et al., 1997) to receive DAT, as they were likely to experience many novel events beyond dolphin interactions, e.g., airline travel, different topography, novel people speaking a different language, etc.

Only Nathanson and de Faria (1993) discussed the possibility that rival hypotheses could explain their study's outcomes. In explaining their finding that children performed better when dolphins served as reinforcers than when toys were used, they mentioned that immersion in warm water may account for the children's performance. They attempted to rule out that possibility by stating that the water used during the toy condition was two degrees warmer than that of the dolphin pen and thus favored the toy condition. They also attempted to rule out novelty effects by stating that children with disabilities usually prefer familiar items, which would have given the toy condition the advantage for improving the children's performance. Furthermore, they state that they used some practice sessions to acquaint the children with the dolphins, thus decreasing novelty. However, since there was only one practice session and one trial session, novelty cannot be ruled out as they suggest.

Conclusion

This practice-based research synthesis focuses on examining the effectiveness of dolphin-assisted therapy with children six years of age or younger with disabilities in order to determine the intervention's implication for practice. Due in large part to the results of the studies comprising this synthesis, as well as similarly designed and implemented studies with adults (Smith, 1983), claims about DAT's efficacy have been widely promoted as having been proven. Yet, the available research evidence, as examined in this synthesis, does not conclusively support the claims that DAT is effective for improving the behaviors of young children with disabilities. More specifically, the results of the synthesis do not support the notion that using interactions with dolphins is any more effective than other reinforcers for improving child learning or social-emotional development. Investigators in all six studies lacked experimental control, thus failing to adequately control for major threats to validity and possible rival hypotheses. Therefore, the outcomes of the studies cannot conclusively be attributed to the intervention (Cook & Campbell, 1979). Parents of young children with disabilities and their practitioners should note that the cost of DAT is high (typically $2600 for five 40-minute sessions) and that currently there is not enough research evidence available to support the use of the practice.

Implications for Research

Since the six studies that met the criteria for this review were not designed or implemented in a manner that allowed for conclusions about the efficacy of DAT to be drawn, it seems plausible to suggest that further study is needed regarding the efficacy of DAT for young children. Such research must use research designs and methods of implementation to eliminate the rival explanations that plague the synthesized studies. A research design using an appropriate sample size that compares DAT to alternative interventions that are just as novel and interesting to children would address some of the threats to validity inherent in the studies. Informative research could be accomplished through either group or single-subject research designs. Single-subject research designs may be especially appropriate for research involving children with disabilities since a limited population for a specific disability may be available for participation. Such designs could effectively control for variations in intervention, treatment fidelity, and other confounds inherent in the studies reviewed for this synthesis. In sum, better-designed and better-controlled research is needed to determine whether DAT is truly an effective intervention that should be promoted to parents and practitioners worldwide.

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Table 1
Selected Characteristics of the Study Participants

Study	Number	Ages (Years)	Gender		Child Diagnosis
			Male	Female	

Lukina (1999)	147	4-12	—	—	Various disabilities
Nathanson (1989)	6	2-6	6	0	Mental retardation
Nathanson (1998)	71	2-12	—	—	Various disabilities
Nathanson et al. (1997)	47	2-13	27	20	Severe disabilities
Nathanson (1989) & de Faria (1993)	8	3-8	5	3	Mental retardation
Servais (1999)	15	1-3[a]	9	4	Autism
			(2 not specified)		

[a]Developmental ages

Table 2
Major Findings and Outcomes Reported by Investigators

Study	Research Design	Independent/Intervention Variables	Outcome Measures	Measurement of Variation in the Intervention	Measurement of Reliability or Validity
Lukina (1999)	One-group, pretest/posttest design	Interactions with dolphins from the dock and in the water	Tests and evaluations (not named or described), parent observations (method of data collection not described), analysis of cardiac rhythms	None	None
Nathanson (1989)	One-group, reverse-treatment design with pretest/posttest	Interactions with dolphins from the dock and in the water	Percent of correct responses	None	None
Nathanson (1998)	One-group, posttest-only survey	Interactions with dolphins from the dock and in the water	Parent survey	None	None
Nathanson et al. (1997)	One-group, pretest/posttest design	Interactions with dolphins from the dock and in the water	Behaviors charted from direct observations	Water temperature measured; used same dolphin, coder, and therapist; sessions at same time of day; no measure of variation of DAT	Interrater reliability for the coders of this study not clearly established
Nathanson & Faria (1993)	One-group, reverse-treatment design with pretest/posttest	Interactions with dolphins from the dock and in the water* Interactions with favorite toys	Videotaped observations	Water temperature measured; same dolphin across sessions; sessions at the same time of day; no measure of variation of DAT	Interrater reliability established for coding videotaped observations of children's behavior (r = .90 for DAT; r = .92 for toys)
Servais (1999)	Two pretest/posttest designs with a control group	Interactions with dolphins from the dock*	Posttest performance on task, videotaped observations of attention	Videotaped observations used to assess variation	No interrater reliability for coding of videotapes

*Direct interactions with dolphins only

Table 3
Major Study Findings and Threats to Validity

Study	Relationship between Practice and Outcomes	Primary Findings	Social-Emotional Findings	Rival Explanations/Major Threats to Validity
Lukina (1999)	Not specified	Improvements in children's automatic	Increased trust in adults and dolphins; newly emerged	No data to support findings other than

		homeostasis and psychoemotional status	kindness, attentiveness to others; and self-control; "cardiac rhythms of children indicated a redistribution of psychoemotional dominants" (p. 678); children with autism or mental retardation displayed "psychoemotional excitation."	cardiac-rhythm data Instrumentation History Maturation Multiple treatment interference Respondent bias Investigator bias Placebo effect Novelty Treatment fidelity
Nathanson (1989)	Author states that water and dolphins contribute to reduction of stress and increase in attention so DAT can improve speech and memory.	More correct responses in the DAT condition than in the classroom condition	None reported	History Maturation Multiple treatment interference No information on reliability or validity of videotape coding Respondent bias Investigator bias
Nathanson (1998)	Children with disabilities have difficulty learning due to inattention to relevant stimuli rather than an inability to process information. Neurological difficulties proposed as cause of the attention problems.	Skills acquired during DAT were maintained or improved 50% of the time; 2 weeks of therapy better than 1 week	Maintenance or improvement ranging from 40% to 69% on socially based survey items	History Maturation Multiple treatment interference Placebo Instrumentation Respondent bias Attrition Demand characteristics
Nathanson et al. (1997)	The attention-deficit hypothesis is the basis for the practice in conjunction with the principles of operant conditioning and an interdisciplinary team model.	DAT results in the acquisition of independent motor and speech-language skills.	None reported	No data provided to support reported findings History Multiple treatment interference Placebo Instrumentation Investigator bias
Nathanson & de Faria (1993)	The attention-deficit hypothesis is the basis for the practice; "animals appear to increase attention, thereby improving cognitive processes" (p. 17)	Better cognitive functioning in the DAT condition than in the toy condition	None reported	History Multiple treatment interference Investigator bias Novelty Treatment fidelity Small sample size
Servais (1999)	"Interactions with dolphins foster learning in autistic children, by increasing their attention faculty and their motivation" (p. 7).	Children in first experimental group performed better than children in a control group. Second experimental group did not perform better than the control group.	Children in the first experimental group established a social link with the experimenters.	Maturation Testing Respondent bias Investigator bias Treatment fidelity Demand

				characteristics