Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder

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Chapter 1
Introduction

Since the discovery of autism as a human condition by Kanner (1943) and Asperger (1944) in the 1940s, individuals responsible for education and care of children and youth with autism spectrum disorder (ASD) have striven to provide effective practices and programs. Such efforts continue today. The increased prevalence of ASD has intensified the demand for effective educational and therapeutic services, and intervention science is now providing evidence about which practices are effective. The purpose of this report is to describe a process for the identification of evidence-based practices (EBPs) and also to delineate practices that have sufficient empirical support to be termed "evidence-based." In this introduction, we will briefly review the current conceptualization of ASD, explain the difference between focused intervention practices and comprehensive treatment models, provide a rationale for narrowing our review to the former, describe other reports that have identified evidence-based practices, briefly describe our first review of the literature (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010), and lastly provide the rationale for conducting an updated review of the literature and revision of the former set of practices identified.

The increased prevalence of ASD has intensified the demand for effective educational and therapeutic services, and intervention science is now providing evidence about which practices are effective.

In Chapter 2, we describe in detail the methodology followed in searching the literature, evaluating research studies, and identifying practices. In Chapter 3, the practices are described along with the type of outcomes individual practices generate and the age of children for whom the outcomes were found. In Chapter 4, we summarize the findings, discuss their relationship to other reviews, compare the current review process to the previous process, identify limitations of this review, and propose implications of study results for practice and future research. In the Appendix, each practice is described and specific studies that provide empirical support for the practice are listed.

Autism Spectrum Disorder: Diagnostic Criteria

The definition of autism has evolved over the years. Early on, Kanner (1943) noted that autism was characterized by failure to develop social relationships and a need for sameness. The characteristics, stated slightly differently, continue to define the condition today. In the United States, the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* published by the American Psychiatric Association (APA, 1994, 2013) has provided the most well accepted diagnostic criteria, and as this report goes into print, the criteria have changed. In the fourth edition of the manual (*DSM IV*), Autistic Disorder was an established condition defined by social, language, and behavioral characteristics, but there were several other conditions that shared similar characteristics [i.e., Asperger syndrome, Rett's syndrome, and Pervasive Developmental Disorders, Not Otherwise Specified (PDD-NOS)]. These diagnostic classifications were grouped under a broader classification called Pervasive Developmental Disorders (American Psychiatric Association, 1994). With the advent of *DSM 5*, there is only one diagnostic classification, termed Autism Spectrum Disorder.

Similar to the earlier diagnostic classification, ASD is identified by two primary diagnostic markers: difficulties in social communication and restricted or repetitive behaviors and interests. Examples of difficulties in social communication include challenges in social reciprocity, nonverbal social behaviors, and establishment of social relationships. Restrictive and repetitive behaviors include stereotypic behavior or speech, excessive adherence to routines, and highly fixated interests. Rather than specify severity of ASD, the *DSM 5* has the option of describing the level of support an individual would need. In addition, in the *DSM 5,* co-occurring conditions, such as intellectual disability or attention deficit hyperactive disorder, may also be diagnosed when a diagnosis of ASD is made. In the *DSM IV*, this overlap was not allowed.

Because our literature review spans several decades and several editions of the *DSM,* we have included studies whose participants are identified as having autism, autistic disorder, ASD, Asperger syndrome, or PDD-NOS. In addition, we have included studies in which participants may also have had co-occurring conditions such as intellectual disability, speech/language impairment, seizure disorder, sensory impairment, and attention deficit hyperactivity disorder.

Demographic Information

The prevalence of ASD, as noted, has increased markedly over the past two decades, rising from 2 per 10,000 in 1990 to between 1 in 50 and 1 in 88 children (Blumberg, et al., 2013; Centers for Disease Control and Prevention, 2012) according to the latest report from the U.S. Centers for Disease Control and Prevention. ASD is diagnosed about three times more frequently in boys than in girls. Intellectual disability was once thought to be a condition that typically accompanied ASD;

however, current estimates are that 35% of individuals with ASD score above the IQ cutoff (i.e., around 70 depending on the test) for intellectual disability (Dykens & Lense, 2011).

Intervention Approaches

Two broad classes of interventions appear in the research literature (Smith, 2013), and we have identified them as comprehensive treatment models and focused intervention practices. Although the current review concentrated on the latter class of interventions, it is important to describe both in order to distinguish the two.

Comprehensive Treatment Models

Comprehensive treatment models (CTMs) consist of a set of practices designed to achieve a broad learning or developmental impact on the core deficits of ASD. In their review of education programs for children with autism, the National Academy of Science Committee on Educational Interventions for Children with Autism (National Research Council, 2001) identified 10 CTMs. Examples included the UCLA Young Autism Program by Lovaas and colleagues (Smith, Groen, & Winn, 2000), the TEACCH program developed by Schopler and colleagues (Marcus, Schopler, & Lord, 2000), the LEAP model (Strain & Hoyson, 2000), and the Denver model designed by Rogers and colleagues (Rogers, Hall, Osaki, Reaven, & Herbison, 2000). In a follow-up to the National Academy review, Odom, Boyd, Hall, and Hume (2010) identified 30 CTM programs operating within the U.S. These programs were characterized by organization (i.e., around a conceptual framework), operationalization (i.e., procedures manualized), intensity (i.e., substantial number of hours per week), longevity (i.e., occur across one or more years), and breadth of outcome focus (i.e., multiple outcomes such as communication, behavior, social competence targeted) (Odom, Boyd, Hall, & Hume, in press).

Focused Intervention Practices

In contrast, focused intervention practices are designed to address a single skill or goal of a student with ASD (Odom et al., 2010). These practices are operationally defined, address specific learner outcomes, and tend to occur over a shorter time period than CTMs (i.e., until the individual goal is achieved). Examples include discrete trial teaching, pivotal response training, prompting, and video modeling. Focused intervention practices could be considered the building blocks of educational programs for children and youth with ASD, and they are highly salient features of the CTMs just described. For example, peer-mediated instruction and intervention (Sperry, Neitzel, & Engelhardt-Wells, 2010), is a key feature of the LEAP model (Strain & Bovey, 2011).

The purpose of the current review is to identify focused intervention practices that have evidence of effectiveness in promoting positive outcomes for learners with ASD. Focused

intervention practices that meet the evidence criteria specified in the next chapter are designated as evidence-based practices (EBP). Teachers and other service providers may select these practices when designing an individualized education or intervention program because of the evidence that they produce outcomes similar to the goals established for children and youth with ASD. Odom, Hume, Boyd, and Stabel (2012) described this as a *technical eclectic* approach and the National Professional Development Center on ASD has designed a process through which these practices could be systematically employed in early intervention and school-based programs (Cox et al., 2013).

Previous Literature Reviews of EBPs for Children and Youth with ASD

The historical roots of EBP for students with ASD are within the evidence-based medicine movement that emerged from England in the 1960s and the formation of the Cochrane Collaboration to host reviews of the literature about scientifically supported practices in medicine (http://www.cochrane.org/). The subsequent adoption of the evidence-based conceptual approach in the social sciences is exemplified in the work of the Campbell Collaboration (http://www.campbellcollaboration.org/) and currently the What Works Clearinghouse (http://ies.ed.gov/ncee/wwc/). In the 1990s, the American Psychological Association Division 12 established criteria for classifying an intervention practice as efficacious or "probably efficacious," which provided a precedent for quantifying the amount and type of evidence needed for establishing practices as evidence-based (Chambless & Hollon, 1998; Chambless et al., 1996).

Previous to the mid-2000s, the identification of EBPs for children and youth with ASD was accomplished through narrative reviews by sets of authors or organizations (e.g., Simpson, 2005). Although these reviews were systematic and useful, they did not follow a stringent review process that incorporated clear criteria for including or excluding studies for the reviews or organizing the information into sets of practices. In addition, many traditional systematic review processes, such as the Cochrane Collaborative, have only included studies that employed a randomized experimental group design (also called randomized control trial or RCT) and have excluded single case design (SCD) studies. By excluding SCD studies, such reviews a) omit a vital experimental research methodology now being recognized as a valid scientific approach (Kratochwill et al., 2013) and b) eliminate the major body of research literature on interventions for children and youth with ASD. Two reviews have specifically focused their work on interventions (also called treatments) for children and youth with ASD, included both group and SCD studies, followed a systematic process for evaluating evidence before including (or excluding) it in their review, and identified a specific set of interventions that have evidence of efficacy. These reviews were conducted by the National Standards Project (NSP) at the National Autism Center (2009) and the National Professional Development Center on ASD (NPDC).

National Standards Project (NSP)

The NSP conducted a comprehensive review of the literature that included early experimental studies on interventions for children and youth with ASD and extended through September 2007 (National Autism Center, 2009). Their search, after excluding articles that did not meet their criteria, yielded a total of 775 studies. Using a standard evaluation process, NSP staff recruited and trained a national set of reviewers, who completed ratings of group and SCD studies. These ratings then generated a "strength of evidence" score, which the NSP staff used to determine which practices were evidence-based. They identified 11 practices as established treatments (see the top row of Table 1). In addition, they identified 22 practices as emerging treatments, meaning that there was some evidence but it was not strong enough to meet the established criteria. Also, they found five practices for which researchers demonstrated, experimentally, that there were no effects, and no practices they would characterize as ineffective/harmful.

National Professional Development Center on ASD (NPDC)

The NPDC also conducted a review of the literature, although it only included articles published over the 10-year period from 1997 to 2007 (Odom, Collet-Klingenberg, et al., 2010). NPDC staff began with a computer search of the literature, first using autism and related terms for the search and specifying outcomes. They then used the research design quality indicator criteria established by the CEC-Division for Research (Gersten et al., 2005; Horner et al., 2005) to evaluate articles for inclusion or exclusion from the review. This review yielded 175 articles. They content analyzed the intervention methodologies, created intervention categories, and sorted articles into those categories. Adapting criteria from the Chambless et al. (1996) group, they found that 24 focused intervention practices met the criteria for being evidence-based (see the left column of Table 1). For some practices that were developed in the 1980s, foundational articles from the earlier time period were included if they were routinely cited in the articles from the 10 year time period. To translate this scientific review into practice, NPDC investigators and staff developed online training modules, which can be accessed from the NPDC website (http://autismpdc.fpg.unc.edu/content/autism-internet-modules-aim).

Similarities Between The Two Reviews

Although the NSP and NPDC reviews were conducted independently and their literature searches cover different time periods, their findings are remarkably similar. The EBPs identified by each group appear in Table 1, with (as noted) the NSP established treatments in the top row and the NPDC EBPs in the first column. Some of the NSP classification of established treatments included several of the focused interventions that NPDC had classified as evidence-based. For example, the NSP antecedent package included three focused interventions NPDC identified, and the NSP

Table 1.
Evidence-Based Practices from NPDC and NSP (Hume & Odom, 2011)

Overlap Between Evidence-Based Practices Identified by the National Professional Development Center (NPDC) on ASD and the National Standards Project (NSP)											
	Established Treatments Identified by the National Standards Project (NSP)										
Evidence-Based Practices Identified by the National Professional Development Center (NPDC) on ASD	Antecedent Package	Behavioral Package	Story-based Intervention Package	Modeling	Naturalistic Teaching Strategies	Peer Training Package	Pivotal Response Treatment	Schedules	Self-Management	Comprehensive Behavioral Treatment for Young Children	Joint Attention Intervention
Prompting	X			X						The NPDC on ASD did not review comprehensive treatment models. Components of The Comprehensive Behavioral Treatment of Young Children overlap with many NPDC-identified practices.	The NPDC on ASD considers joint attention to be an outcome rather than an intervention. Components of joint attention interventions overlap with many NPDC-identified practices.
Antecedent-Based Intervention	X										
Time delay	X										
Reinforcement		X									
Task analysis		X									
Discrete Trial Training		X									
Functional Behavior Analysis		X									
Functional Communication Training		X									
Response Interruption/Redirection		X									
Differential Reinforcement		X									
Social Narratives			X								
Video Modeling				X							
Naturalistic Interventions					X						
Peer Mediated Intervention						X					
Pivotal Response Training							X				
Visual Supports								X			
Structured Work Systems								X			
Self-Management									X		
Parent Implemented Intervention	The NSP did not consider parent-implemented intervention as a category of evidence-based practice. However, 24 of the studies reviewed by the NSP under other intervention categories involve parents implementing the intervention.										
Social Skills Training Groups	Social Skills Training Groups (Social Skills Package) was identified as an emerging practice by the NSP.										
Speech Generating Devices	Speech Generating Devices (Augmentative and Alternative Communication Device) was identified as an emerging practice by the NSP.										
Computer Aided Instruction	Computer Aided Instruction (Technology-based Treatment) was identified as an emerging practice by the NSP.										
Picture Exchange Communication	Picture Exchange Communication System was identified as an emerging practice by the NSP.										
Extinction	Extinction (Reductive Package) was identified as an emerging practice by the NSP.										

behavioral package incorporated seven NPDC EBPs. There were six NPDC focused intervention EBPs that did not appear in the NSP list of established treatments, but five of the six had been identified by NSP as emerging practices. In all, the message was one of convergence across two independent data sources.

Rationale for Current NPDC Review

The NPDC staff undertook the current review to broaden and update the previous review. Many researchers have made recent contributions to the ASD intervention literature, so one purpose of the current review was to incorporate the intervention literature from the years subsequent to the initial review (i.e., 2007-2011). A second purpose was to expand the timeframe previous to the initial review, extending the coverage to 1990 to be consistent with other research synthesis organizations in going back approximately 20 years (e.g., What Works Clearinghouse, WWC). The third purpose was to create and utilize a broader and more rigorous review process than occurred in the previous review. In the current review, we recruited and trained a national set of reviewers to evaluate articles from the literature rather than relying exclusively on NPDC staff. Also, we developed a standard article evaluation process that incorporated criteria from several parallel reviews that have occurred (NSP; WWC). As such, the review that we present in the following chapters includes a new and expanded database of articles, a new evaluation process, and new or modified focused intervention categories.

Chapter 2
Method

IN THIS CHAPTER, we describe the methodology utilized in this EBP review. An initial description of inclusion/exclusion criteria for studies is followed by a summary of the search process and articles accessed for the review. Reviewer training, the review process, and the process for documentary evidence-based practices conclude the chapter.

Inclusion/Exclusion Criteria for Studies in the Review

Articles included in this review were published in peer-reviewed, English language journals between 1990 and 2011 and tested the efficacy of focused intervention practices. Using a conceptual framework followed by the Cochrane Collaborative [Participants, Interventions, Comparison, Outcomes, Study Design (PICO)], we list the study inclusion criteria in Table 2.

Population/Participants

To qualify for the review, participants in a study had to be between birth and 22 years of age and identified as having ASD: autism, Asperger syndrome, pervasive developmental disorder (PDD), pervasive developmental disorder-not otherwise specified (PDD-NOS), or high-functioning autism (HFA). Individuals with ASD who also had co-occurring conditions were included in this review. These conditions could be intellectual disability, genetic syndrome (e.g., Fragile X, Down syndrome), seizure disorder, mental illness (e.g., anxiety, depression, obsessive compulsive disorder), attention deficit/hyperactivity disorder x(ADHD), physical disability (e.g., cerebral palsy, orthopedic impairment), sensory impairment (e.g., hearing or visual impairment), or learning disability.

Table 2. Inclusion Criteria for Studies

Population/ Participants	Individuals with ASD between birth and 22 years of age
Interventions:	Behavioral, developmental, or educational in nature and could be implemented in typical educational intervention settings (school, home, community)
Comparison	Interventions compared to no intervention or alternate intervention conditions
Outcomes	Behavioral, developmental, or academic outcomes
Study Design	Experimental group design, quasi-experimental group design, or single-case design

Interventions

To be included in this review, the focused intervention practices examined in a study had to be behavioral, developmental, and/or educational in nature. Studies in which the independent variables were only medications, alternative/complementary medicine (e.g., chelation, neurofeedback, hyperbaric oxygen therapy, acupuncture), or nutritional supplements/special diets (e.g., melatonin, gluten-casein free, vitamins) were excluded from the review. In addition, only interventions that could be practically implemented in typical educational, home, or community settings were included. As such, intervention practices requiring highly specialized materials, equipment, or locations unlikely to be available in most educational, clinic, community, or home settings were also excluded (e.g., dolphin therapy, hyperbaric chambers).

Comparison

For inclusion in the review, the design of the study had to compare an experimental or treatment condition (i.e., in which the focused intervention practice was implemented) to at least one other condition in which the treatment was not implemented or an alternative intervention condition was implemented. All relevant features of the comparison condition had to be described to allow for a clear understanding of the differences between the conditions. If the control was "business as usual" instruction, the instructional or classroom environment had to be described.

Outcomes

Additionally, focused intervention practices had to generate behavioral, developmental, or academic outcomes (i.e., these were dependent variables in the studies). These outcome data could be discrete behaviors (e.g., social initiations, stereotypes) assessed observationally, ratings of behavior or student performance (e.g., the *Social Responsiveness Scale*), standardized assessments (e.g., nonverbal IQ tests, developmental assessments), and/or informal assessment of student academic performances (e.g., percentage of correct answers on an instructional task, time). Studies reporting both behavioral and health/medical outcomes for children were included, but studies only reporting physical health outcomes were excluded from the review. Studies reporting only mental health outcomes were included.

Study design

Finally, studies included in the review had to employ an experimental group design, quasi-experimental design, or SCD to test the efficacy of focused intervention practices. Adequate group designs included randomized controlled trials (RCT), quasi-experimental designs (QED), or regression discontinuity designs (RDD) that compared an experimental/treatment group receiving the intervention to at least one other control or comparison group that did not receive

the intervention or received another intervention (Shadish, Cook, & Campbell, 2002). SCD studies had to employ within subjects (cases) designs that compared responding of an individual in one condition to the same individual during another condition. Acceptable SCDs for this review were withdrawal of treatment (e.g., ABAB), multiple baseline, multiple probe, alternating treatment, and changing criterion designs (Kratchowill et al., 2013).

Search Process

Research articles were obtained through an electronic library search of published studies. Before beginning the search, our research team and two university librarians from the University of North Carolina at Chapel Hill developed and refined the literature search plan. One librarian had special expertise in the health sciences literature and the second had expertise in the behavioral and social sciences literature.

Library databases representing a range of disciplines were used in the literature search. These databases were:

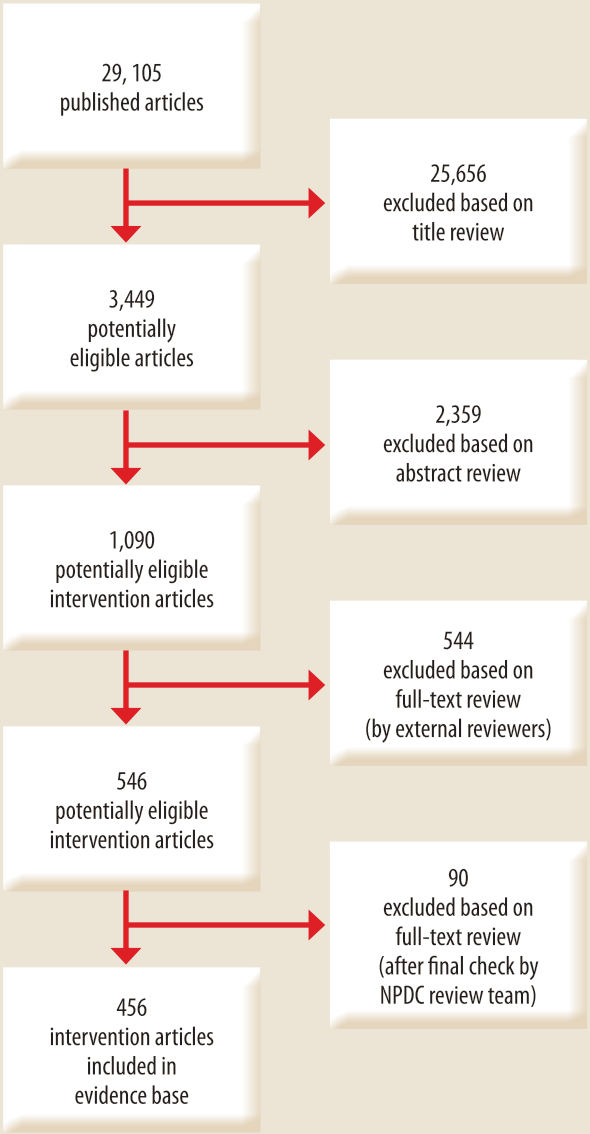
- Academic Search Complete
- Cumulative Index to Nursing and Allied Health Literature (CINAHL)
- Excerpta Medica Database (EMBASE)
- Educational Resource Information Center (ERIC)
- PsycINFO
- Social Work Abstracts
- MEDLINE
- Thomson Reuters (ISI) Web of Knowledge
- Sociological Abstracts

Unlike our previous review, we designed search terms very broadly to increase the likelihood that we would identify all studies meeting the inclusion criteria. For a comprehensive search of the ASD intervention literature, search terms were limited to two categories: one category of terms to capture articles studying individuals with ASD (i.e., any of the terms in the diagnostic column of Table 3) and one category of terms to retrieve articles testing an intervention (i.e., any of the terms in the intervention column of Table 3). Terms were modified as necessary when searching the different databases. The only filters used were language (English) and publication date (1990–2011).

Table 3. Search Terms

Category	Qualifying Terms
Diagnostic	**autism** OR **Asperger** OR **pervasive developmental disorder**
	AND
Intervention	**intervention** OR **treatment** OR **practice** OR **strategy** OR **therapy** OR **program** OR **procedure**

Figure 1.
Screening progression and number of articles



After eliminating duplicate articles retrieved from the different databases, the initial broad search yielded 29,106 articles that related to ASD and intervention. The research team then conducted two rounds of screening to select articles that fit the study parameters (see Figure 2). The first round of screening focused on titles. Since the search terms were broad, approximately 88 percent of the articles did not meet the study inclusion criteria. Articles excluded at this stage were primarily those that clearly stated in the title to be commentaries, letters to the editor, reviews, and biological or medical studies. The second round of screening was an examination of abstracts to determine if the article included participants with ASD under 22 years of age and used an experimental group design, quasi-experimental group design, or SCD. In both rounds of screening, articles were retained if the necessary information was not clearly presented in the titles and abstracts (i.e., if the reviewer could not tell from the title or abstract if the article was appropriate). This screening procedure resulted in 1,090 articles, 213 utilizing a group design and 877 using SCD methodology. All of these articles were retrieved and archived in PDF form for the next step in the review process.

Review Process

The review process consisted of establishing review criteria, recruiting reviewers, training reviewers, and conducting the review.

Review Criteria and Protocols

Protocols for reviewing group design and SCD studies were used to determine methodological acceptability (see Appendix 1), to describe the key features of the study (e.g., participants, type of design), and to describe the intervention procedures. The initial protocols drew from the methodological quality indicators developed by Gersten and colleagues (2005) for group design and Horner et al. (2005) for SCD, as well as the current review guidelines established by the WWC. Protocols went through two iterations of pilot testing within the research group and then

were reviewed by two national leaders in research methodology and intervention research, with expertise in SCD and group design, respectively. From this process the protocols were finalized and formatted for online use.

Recruiting Reviewers

To assist in reviewing the identified articles, external reviewers were recruited through professional organizations (e.g., Association for Behavior Analysis International, Council for Exceptional Children) and departments of education, psychology, health sciences, and related fields in higher-education institutions. To be accepted as a reviewer, individuals must have had some experience with or knowledge about ASD and have taken a course or training related to group design and/or SCD research methodology. The reviewers self-identified their methodological expertise and interests as group, SCD, or both.

Reviewer Training

For both design types, the research team developed training procedures for external reviewers that included an online training module describing the project and explaining each item on the review protocols. Additionally, examples and non-examples of each protocol item were presented in the training. The training modules also included instructions for coding descriptive features of articles that were determined as having acceptable experimental methodology. Reviewers coded participant information (diagnosis, co-occurring conditions, age), intervention information (name, description, and intervention category), and outcomes (variable name, description, and outcome category). Reviewers could also identify any concerns or issues encountered during the article review process.

After completing the reviewer training, external reviewers were required to demonstrate that they could accurately apply reviewer criteria by evaluating one article of their assigned design type. The reviewer's evaluation was then compared to a master code file established for the article and their accuracy was calculated. Accuracy was defined as the rater coding the same answer on an item as occurred in the master code file. Criterion for acceptable accuracy was set at 80%. In addition, reviewers were required to correctly determine whether the article met minimum criteria for review eligibility (see the section on inclusion/exclusion criteria).

Reviewers had two opportunities to meet accuracy criteria. If reviewers met qualifications and expressed interest in reviewing group design articles, they completed the group design training module and established inter-rater agreement with a group design study. If reviewers met qualifications and expressed interest in reviewing SCD articles, they completed the SCD training module and established inter-rater agreement with only the SCD study. If reviewers met qualifications and expressed interest in reviewing both types of design, they completed both training

Table 4. Reviewer Demographics	
Reviewer Training/Certification	**n**
Single case design	100
Group design	39
Single case and group design	20
Degree level	**n**
Masters degree or current graduate student	65
Doctorate	94
Degree area	**n**
Applied Behavior Analysis	9
Education	11
Occupational Sciences	3
Psychology	28
School Psychology	5
Special Education	97
Speech/Language	3
Other (music, neurology, social work)	3
Current Position	**n**
Faculty	68
Researcher	14
Graduate student	46
Practitioner/administrator	31
Experience with ASD*	**n**
Teaching in classroom setting	109
Providing intervention in clinical setting	76
Providing intervention in home setting	103
Conducting ASD research	117
Teaching college level course on ASD	84

*Reviewers may have reported more than one type of experience with ASD

modules and had to establish inter-rater agreement with both types of articles.

One hundred fifty-nine reviewers completed the training and met inter-rater agreement criteria with the master code files. All reviewers had a doctoral degree, master's degree, or were enrolled in a graduate education program at the time of the review. Most reviewers received their degrees in the area of special education or psychology and were faculty (current or retired), researchers, or graduate students. The majority of reviewers had professional experience in a classroom, clinic, or home setting and conducted research related to individuals with ASD. In addition, approximately one-third of the reviewers (n=53) had Board Certified Behavior Analyst (BCBA) or Board Certified Assistant Behavior Analyst (BCaBA) certification. All reviewers received a certificate of participation in the EBP training and article review. Continuing education credits were available to certified BCBA/BCaBA reviewers. Information about reviewers appears in Table 4.

Inter-rater Agreement

Research staff collected inter-rater agreement for 41% of the articles across all reviewers. The formula for inter-rater agreement was total agreements divided by agreements plus disagreements multiplied by 100%. Two levels of agreement were calculated: 1) agreement on individual items of the review protocol and 2) agreement on the summative evaluation of whether a study met or did not meet criteria for inclusion in the review. Mean inter-rater agreement on the individual study design evaluation criteria was 84% for group design articles and 92% for SCD articles, generating a total mean agreement of 91%. Mean inter-rater agreement for summary decisions about article inclusion was 74% for group design articles and 77% for SCD articles, generating a total agreement of 76%.

Final Review Process

Each reviewer received between 5 and 12 articles. In total, they evaluated 1,090 articles. Articles that did not meet all the criteria in the group or SCD protocols were excluded from the database of articles providing evidence of a practice. As a final check, members of the EBP evaluation team reviewed each article that had been identified as meeting criteria by reviewers as well as articles

that were flagged by reviewers for further review by the evaluation team. Studies that did not meet criteria were then eliminated from the database.

Analysis and Grouping Literature

The review process resulted in 456 articles meeting inclusion criteria for study parameters. A process of content analysis (Krippendorff, 1980) was then followed using procedures established in the first NPDC review (Odom, Collet-Klingenberg, et al., 2010). Because categories for practices were already created by the NPDC (e.g., reinforcement, discrete trial teaching, pivotal response training), these categories and established definitions were initially used to sort the articles. If a practice was not sorted into an existing category, it was placed in a general "outlier" pool. A second round of content analysis was then conducted to create new categories. Following a constant comparative method, a category and definition was created for a practice in the first outlier study, the intervention practice in the second study was compared to the first study and if it was not similar, a second practice category and definition was created. This process continued until studies were either sorted into the new categories or the study remained as an idiosyncratic practice. Seven articles were used to support two different practice categories because it either demonstrated efficacy of two different practices as compared to a control group or baseline phase or the article presented several studies showing efficacy for different practices. Finally, research staff reviewed all articles sorted into categories. For individual studies, they compared the practices reported in the method section with the definition of the practice into which the study had been sorted.

When all articles were assembled into categories, a final determination was then made about whether a practice met the level of evidence necessary to be classified as an EBP using criteria for evidence established by the NPDC. The NPDC's criteria were drawn from the work of Nathan and Gorman (2007), Rogers and Vismara (2008), Horner and colleagues (2005), and Gersten and colleagues (2005), as well as the earlier work by the APA Division 12 (Chambless & Hollon, 1998). It specifies that a practice is considered evidence-based if it was supported by: (a) two high quality experimental or quasi-experimental design studies conducted by two different research groups, or (b) five high quality single case design studies conducted by three different research groups and involving a total of 20 participants across studies, or (c) there is a

Criteria for Qualification as an Evidence-Based Practice

- At least two high quality experimental or quasi-experimental group design articles
  - Conducted by at least two different researchers or research groups

OR

- At least five high quality single case design articles
  - Conducted by at least three different researchers or research groups
  - Having a total of at least 20 participants across studies

OR

- A combination of at least one high quality experimental or quasi-experimental group design article and at least three high quality single case design articles
  - Conducted by at least two different research groups

combination of research designs that must include at least one high quality experimental/quasi-experimental design, three high quality single case designs, and be conducted by more than one researcher or research group. These criteria are aligned with criteria proposed by other agencies and organizations (Chambless & Hollon, 1998; Kratochwill & Sheroff, 2002; Odom et al., 2004).

Chapter 3
Results

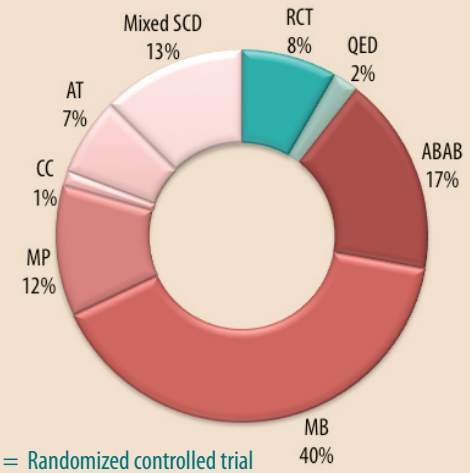
IN THIS CHAPTER, we report the findings from the evidence-based practices review. The summary of these findings includes information about the types of experimental designs employed in the studies, participants, the identified evidence-based practices, outcomes addressed by the EBPs, and practices that had some empirical support but did not meet the criteria for this review.

Design Types

Of the 456 studies accepted as providing scientific evidences, 48 utilized a group design (see Figure 2). The majority (n=38) of group design studies were randomized controlled trials (i.e., experimental group designs), although authors also employed quasi-experimental designs in 10 studies.

The majority of the efficacy research in this review was from SCD studies. Researchers employed SCD in 408 articles. Multiple baseline designs were used most frequently (n=183), although withdrawal of treatment (n=79) and multiple probe design (n=52) also were utilized in a substantial number of articles. In addition, researchers sometimes employed a combination of designs, such as a withdrawal of treatment embedded in a multiple baseline design, which was classified as a mixed design (n=57).

Figure 2. Study Designs



RCT = Randomized controlled trial
QED = Quasi-experimental design
ABAB = Withdrawal of treatment
MB = Multiple baseline
MP = Multiple probe
CC = Changing criterion
AT = Alternating treatment

Table 5. Nature of Literature Base

Diagnosis*	Participants (n)
Autism	382
PDD/PDD-NOS	64
Autism Spectrum Disorder	56
Asperger Syndrome/HFA	40
Co-occurring Condition*	
No co-occurring conditions reported	283
Intellectual disability	116
Speech/language impairment	21
Sensory impairment	14
Epilepsy/seizure disorder	14
ADHD	11
Physical disability	8
Genetic syndrome	6
Learning disability	5
Developmental delay	5
Mental Illness	3
Other (i.e., neurological disorder, hyperthyroidism, Tourette syndrome, otitis media)	16

*Studies may have reported more than one diagnosis and/or co-occurring condition.

PDD/PDD-NOS = Pervasive Developmental Disorder or Pervasive Development Disorder Not Otherwise Specified
HFA = High Functioning Autism
ADHD = Attention Deficit Hyperactive Disorder

Participants

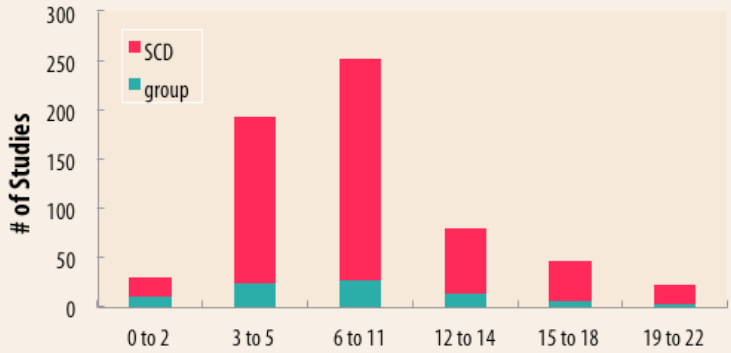
Table 5 contains the number of studies in which a participant descriptor or co-occurring condition was identified by authors; this list of descriptors is not mutually exclusive (i.e., one study could have multiple descriptors). In the majority of studies, authors described participants as having autism, which was usually confirmed by a formal diagnosis. Other terms, which under DSM 5 would be classified as ASD, were also used to describe participants (i.e., PDD/PDD-NOS, Asperger/High Functioning Autism, and actually ASD). Co-occurring conditions were identified in a substantial minority (37.9%) of studies. The co-occurring condition descriptor identified most frequently was intellectual disability (25.4% of all studies).

The majority of the participants in studies were children between the ages of 6 and 11 years, with preschool-aged children (3–5 years) also participating in a large proportion of studies (see Figure 3). Relatively fewer studies included children below three years of age (i.e., in early intervention). While a substantial minority of studies included participants above 12 years of age, this number declined as the ages increased.

Outcomes

Although studies in the literature incorporated a wide range of outcomes, research focused primarily on outcomes associated with the core symptoms of ASD: social, communication, and challenging behaviors (Table 6). Researchers focused on communication and social outcomes most frequently, followed closely by challenging behaviors. Play and joint attention were also reported in a considerable number of studies, perhaps reflecting the large representation in the literature of studies with preschool children. However, school readiness and pre-academic/academic outcomes also

Figure 3. Ages of Participants in Studies



appeared in a substantial number of studies, perhaps reflecting the elementary school age range of participants in many studies. Outcomes of concern in the adolescent years, such as vocational skills and mental health, appeared infrequently in studies.

Table 6. Outcomes Identified In Studies	
Outcomes related to	**Studies (n)**
Social Skills needed to interact with others	165
Communication Ability to express wants, needs, choices, feelings, or ideas	182
Challenging/Interfering Behaviors Decreasing or eliminating behaviors that interfere with the individual's ability to learn	158
Joint Attention Behaviors needed for sharing interests and/or experiences	39
Play Use of toys or leisure materials	77
Cognitive Performance on measures of intelligence, executive function, problem solving, information processing, reasoning, theory of mind, memory, creativity, or attention	15
School Readiness Skills Performance during a task that is not directly related to task content	67
Pre-Academic/Academic Performance on tasks typically taught and used in school settings	58
Motor Movement or motion, including both fine and gross motor skills, or related to sensory system/sensory functioning	18
Adaptive/Self-Help Independent living skills and personal care skills	55
Vocational Employment or employment preparation or relate to technical skills required for a specific job	12
Mental Health Emotional well-being	1

Evidence-Based Practices

Twenty-seven practices met the criteria for being evidence-based. These practices with their definitions appear in Table 7. Also, Appendix 2 contains a fact sheet for each intervention, with the definition of the intervention, the type of outcomes it has generated, the age range of participants, and citations for the specific articles that provide the evidence for the efficacy of the practice. The evidence-based practices consist of interventions that are fundamental applied behavior analysis techniques (e.g., reinforcement, extinction, prompting), assessment and analytic techniques that are the basis for intervention (e.g., functional behavior assessment, task analysis), and combinations of primarily behavioral practices used in a routine and systematic way that fit together as a replicable procedure (e.g., functional communication training, pivotal response training). Also, the process through which an intervention is delivered defines some practices (e.g., parent-implemented interventions, technology-aided interventions).

The number of studies identified in support of each practice also appears in Table 7. As noted, SCD was the predominant design methodology employed, and some practices had very strong support in terms of the number of studies that documented their efficacy (e.g., antecedent-based intervention, differential reinforcement, prompting, reinforcement, video modeling). Other practices had strong support from studies using either SCD or group design methodologies (e.g., parent-implemented interventions, social narratives, social skills training, technology-aided instruction and intervention, visual supports). No practices were exclusively supported through group design methodologies.

Table 7. Working Definitions for EBPs

Evidence-Based Practice	Definition	Empirical Support	
		Group (n)	Single Case (n)
Antecedent-based intervention (ABI)	Arrangement of events or circumstances that precede the occurrence of an interfering behavior and designed to lead to the reduction of the behavior.	0	32
Cognitive behavioral intervention (CBI)	Instruction on management or control of cognitive processes that lead to changes in overt behavior.	3	1
Differential reinforcement of Alternative, Incompatible, or Other Behavior (DRA/I/O)	Provision of positive/desirable consequences for behaviors or their absence that reduce the occurrence of an undesirable behavior. Reinforcement provided: a) when the learner is engaging in a specific desired behavior other than the inappropriate behavior (DRA), b) when the learner is engaging in a behavior that is physically impossible to do while exhibiting the inappropriate behavior (DRI), or c) when the learner is not engaging in the interfering behavior (DRO).	0	26
Discrete trial teaching (DTT)	Instructional process usually involving one teacher/service provider and one student/client and designed to teach appropriate behavior or skills. Instruction usually involves massed trials. Each trial consists of the teacher's instruction/presentation, the child's response, a carefully planned consequence, and a pause prior to presenting the next instruction.	0	13
Exercise (ECE)	Increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behavior.	3	3
Extinction (EXT)	Withdrawal or removal of reinforcers of interfering behavior in order to reduce the occurrence of that behavior. Although sometimes used as a single intervention practice, extinction often occurs in combination with functional behavior assessment, functional communication training, and differential reinforcement.	0	11
Functional behavior assessment (FBA)	Systematic collection of information about an interfering behavior designed to identify functional contingencies that support the behavior. FBA consists of describing the interfering or problem behavior, identifying antecedent or consequent events that control the behavior, developing a hypothesis of the function of the behavior, and/or testing the hypothesis.	0	10
Functional communication training (FCT)	Replacement of interfering behavior that has a communication function with more appropriate communication that accomplishes the same function. FCT usually includes FBA, DRA, and/or EX.	0	12
Modeling (MD)	Demonstration of a desired target behavior that results in imitation of the behavior by the learner and that leads to the acquisition of the imitated behavior. This EBP is often combined with other strategies such as prompting and reinforcement.	1	4
Naturalistic intervention (NI)	Intervention strategies that occur within the typical setting/activities/routines in which the learner participates. Teachers/service providers establish the learner's interest in a learning event through arrangement of the setting/activity/routine, provide necessary support for the learner to engage in the targeted behavior, elaborate on the behavior when it occurs, and/or arrange natural consequences for the targeted behavior or skills.	0	10
Parent-implemented intervention (PII)	Parents provide individualized intervention to their child to improve/increase a wide variety of skills and/or to reduce interfering behaviors. Parents learn to deliver interventions in their home and/or community through a structured parent training program.	8	12
Peer-mediated instruction and intervention (PMII)	Typically developing peers interact with and/or help children and youth with ASD to acquire new behavior, communication, and social skills by increasing social and learning opportunities within natural environments. Teachers/service providers systematically teach peers strategies for engaging children and youth with ASD in positive and extended social interactions in both teacher-directed and learner-initiated activities.	0	15

Evidence-Based Practice	Definition	Empirical Support	
		Group (n)	Single Case (n)
Picture Exchange Communication System (PECS)	Learners are initially taught to give a picture of a desired item to a communicative partner in exchange for the desired item. PECS consists of six phases which are: (1) "how" to communicate, (2) distance and persistence, (3) picture discrimination, (4) sentence structure, (5) responsive requesting, and (6) commenting.	2	4
Pivotal response training (PRT)	Pivotal learning variables (i.e., motivation, responding to multiple cues, self-management, and self-initiations) guide intervention practices that are implemented in settings that build on learner interests and initiative.	1	7
Prompting (PP)	Verbal, gestural, or physical assistance given to learners to assist them in acquiring or engaging in a targeted behavior or skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill.	1	32
Reinforcement (R+)	An event, activity, or other circumstance occurring after a learner engages in a desired behavior that leads to the increased occurrence of the behavior in the future.	0	43
Response interruption/ redirection (RIR)	Introduction of a prompt, comment, or other distracters when an interfering behavior is occurring that is designed to divert the learner's attention away from the interfering behavior and results in its reduction.	0	10
Scripting (SC)	A verbal and/or written description about a specific skill or situation that serves as a model for the learner. Scripts are usually practiced repeatedly before the skill is used in the actual situation.	1	8
Self-management (SM)	Instruction focusing on learners discriminating between appropriate and inappropriate behaviors, accurately monitoring and recording their own behaviors, and rewarding themselves for behaving appropriately.	0	10
Social narratives (SN)	Narratives that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding. Social narratives are individualized according to learner needs and typically are quite short, perhaps including pictures or other visual aids.	0	17
Social skills training (SST)	Group or individual instruction designed to teach learners with autism spectrum disorders (ASD) ways to appropriately interact with peers, adults, and other individuals. Most social skill meetings include instruction on basic concepts, role-playing or practice, and feedback to help learners with ASD acquire and practice communication, play, or social skills to promote positive interactions with peers.	7	8
Structured play group (SPG)	Small group activities characterized by their occurrences in a defined area and with a defined activity, the specific selection of typically developing peers to be in the group, a clear delineation of theme and roles by adult leading, prompting, or scaffolding as needed to support students' performance related to the goals of the activity.	2	2
Task analysis (TA)	A process in which an activity or behavior is divided into small, manageable steps in order to assess and teach the skill. Other practices, such as reinforcement, video modeling, or time delay, are often used to facilitate acquisition of the smaller steps.	0	8
Technology-aided instruction and intervention (TAII)	Instruction or interventions in which technology is the central feature supporting the acquisition of a goal for the learner. Technology is defined as "any electronic item/ equipment/ application/or virtual network that is used intentionally to increase/maintain, and/or improve daily living, work/productivity, and recreation/leisure capabilities of adolescents with autism spectrum disorders" (Odom, Thompson, et al., 2013).	9	11

Evidence-Based Practice	Definition	Empirical Support	
		Group (n)	Single Case (n)
Time delay (TD)	In a setting or activity in which a learner should engage in a behavior or skill, a brief delay occurs between the opportunity to use the skill and any additional instructions or prompts. The purpose of the time delay is to allow the learner to respond without having to receive a prompt and thus focuses on fading the use of prompts during instructional activities.	0	12
Video modeling (VM)	A visual model of the targeted behavior or skill (typically in the behavior, communication, play, or social domains), provided via video recording and display equipment to assist learning in or engaging in a desired behavior or skill.	1	31
Visual support (VS)	Any visual display that supports the learner engaging in a desired behavior or skills independent of prompts. Examples of visual supports include pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, and timelines.	0	18

In Table 8, we identify for each practice the outcomes produced by the studies identified and reviewed. Most EBPs produced outcomes across multiple developmental and skill areas. The range of outcome areas was between three and 11. EBPs with the most dispersed (across areas) outcomes were prompting, reinforcement, technology, time delay, and video modeling (i.e., all with outcomes in at least 10 areas). EBPs with outcomes in the fewest areas were Picture Exchange Communication System (i.e., three outcome areas), pivotal response training (i.e., 3 outcomes), exercise (i.e., four outcomes), functional behavior assessment (i.e., five outcomes), and social skills training (i.e., five outcomes). It is important to note that the number of outcomes improved is not associated with the potency of the intervention. This table reflects the limited number of interventions that have been directed to vocational and mental health outcomes.

Outcomes are also analyzed by age of the participants. The table reflects the point made previously that much of the research has been conducted with children (age <15 years) rather than adolescents and young adults. Some EBPs and outcomes were logically associated with the young age range and were represented in that way in the data. For example, naturalistic intervention and parent-implemented intervention are EBPs that are often used with young children with ASD and produced effects for young children across outcome areas. However, many EBPs extended across age ranges and outcomes. For example, technology-aided instruction and intervention produced outcomes across a variety of areas and ages.

Table 8. Matrix of Evidence-Based Practices by Outcome and Age (years)

EBP	Social			Communi-cation			Behavior			Joint Attention			Play			Cognitive			School Readiness			Academic			Motor			Adaptive			Vocational			Mental Health		
	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22	0-5	6-14	15-22
ABI	■	▒	■	■	▒	■	■	▒	■					▒						▒			▒	■		▒			▒							
CBI		▒			▒			▒	■								▒												▒						▒	
DRA/I/O	■	▒			▒		■	▒	■		▒			▒					■	▒			▒			▒			▒	■						
DTT	■	▒		■	▒			▒		■	▒								■			■	▒					■	▒			▒				
ECE							■	▒											■	▒		■				▒										
EXT		▒		■	▒	■	■	▒	■		▒									▒								■	▒							
FBA					▒		■	▒	■										■	▒		■	▒						▒							
FCT	■	▒		■	▒	■	■	▒	■				■	▒					■	▒								■	▒	■						
MD	■	▒	■	■	▒	■				■				▒					■			■											■			
NI	■	▒		■	▒		■			■			■									■														
PII	■	▒		■	▒		■	▒		■			■	▒		■			■			■						■	▒							
PMII	■	▒	■	■	▒					■	▒		■	▒					■				▒	■												
PECS	■	▒		■	▒						▒																									
PRT	■	▒		■	▒								■	▒																						
PP	■	▒		■	▒			▒	■	■	▒		■	▒					■	▒	■	■	▒	■	■	▒		■	▒	■			■			
R+	■	▒	■	■	▒	■	■	▒	■	■		■	■	▒	■		▒		■	▒		■	▒		■			■	▒	■		▒	■			
RIR	■	▒		■	▒		■	▒	■				■	▒					■	▒								■	▒							
SC	■	▒	■	■	▒	■				■	▒		■	▒		■	▒		■	▒												▒				
SM		▒			▒			▒	■					▒					■	▒	■	■											■			
SN	■	▒		■	▒		■	▒	■	■	▒		■	▒						▒		■	▒					■	▒							
SST	■	▒	■	■	▒		■	▒					■	▒	■		▒																			
SPG		▒			▒			▒						▒						▒			▒													
TA		▒		■	▒					■	▒												▒			▒			▒							
TAII	■	▒	■	■	▒	■		▒	■		▒	■				■			■	▒	■	■	▒	■			■			■		▒	■			
TD	■	▒		■	▒	■	■	▒		■	▒		■	▒		■	▒		■	▒		■	▒		■			■								
VM	■	▒	■	■	▒			▒		■	▒		■	▒	■		▒		■	▒		■	▒		■			■	▒	■		▒	■			
VS	■	▒	■	■	▒		■	▒					■	▒		■			■	▒		■	▒			▒			▒							

A shaded box represents that at least one study meeting criteria included participants in the given age group and reported improvement on a given outcome

Table 9. Idiosyncratic Behavioral Intervention Packages and EBP Components	
Study	**EBPs Employed**
Cihak (2007)	DTT, TD
DeQuinzio, Townsend, & Poulson (2008)	PP, R+, TA
Ganz, Flores, & Lashley (2011)	DR, MD
Gena (2006)	PP, R+
Gena, Krantz, McClannahan, & Poulson (1996)	DTT, MD, PP, R+
Kaplan-Reimer, Sidener, Reeve, & Sidener (2011)	PP, R+, TA
Kuhn, Hardesty, & Sweeney (2009)	ABI, EXT, FCT
Marcus, Sinnott, Bradley, & Grey (2010)	DR, PP
Matson, Taras, Sevin, Love, & Fridley (1990)	MD, PP, R+, TA
Pelios, MacDuff, & Axelrod (2003)	PP, R+
Post & Kirkpatrick (2004)	NI, PP
Strain, Wilson, & Dunlap (2011)	ABI, DR, FBA
Williams, Pérez-González, & Vogt (2003)	MD, PP, R+

Other Practices with Some Support

Some practices had empirical support from the research literature, but they were not identified as EBPs. In some studies, researchers combined practices into behavioral packages to address special intervention goals, but the combination of practices was idiosyncratic. In other cases, an intervention practice did not have the required number of studies to meet the EBP criteria or there were characteristics about the studies (i.e., all conducted by one research group) that prevented their inclusion. All are described in this section.

Idiosyncratic Behavioral Intervention Packages

In the studies categorized as behavioral packages, researchers selected combinations of EBPs and other practices to create interventions to address participants' individual and unique goals. These behavioral packages were only classified as EBPs when procedural combinations were replicated across studies (e.g., PRT, FCT). The behavior package studies appear in Table 9 along with the EBPs they incorporated into their interventions. An example of this combination is the study by Strain, Wilson, and Dunlap (2011) in which the authors used functional behavior assessment, antecedent intervention, and differential reinforcement of alternative behavior to address the problem behaviors of three children with ASD.

Other Practices with Empirical Support

Some focused intervention practices had empirical support from the literature but did not meet the methodological criteria established for this review. The reasons for their exclusion were that 1) there was an insufficient number of studies documenting efficacy, or 2) there was a sufficient number of acceptable studies but the studies were conducted by only one research group, or 3) there were a sufficient number of SCD studies but there were not a sufficient number of total participants across studies (i.e., 20 or more).

The authors caution the reader here, and again in the discussion section (i.e., this caution bears repeating), to be careful in interpreting the findings of Table 10. The empirical support is not equivalent across practices. Some interventions have support from multiple studies demonstrating efficacy. Behavioral momentum interventions, direct instruction, independent work systems, joint attention and symbolic play instruction, music therapy, and reciprocal imitation

training are examples of such interventions, which will be discussed in the next chapter. Interventions with only one study providing support should be treated with the most caution, which is also discussed in the next chapter.

Table 10. Other Focused Intervention Practices with Some Support

Practice	Description	Evidence	Exclusion
Aided Language Modeling	Use of several augmentative and alternative communication strategies (e.g., pointing with finger, sequential pointing, use of communication symbol and vocalization together)	Drager et al. (2006)	Insufficient evidence
Auditory Integration Training	Systematic exposure to modulated tones resulting in changes in parent reported problem behavior	Edelson et al. (1999)	Insufficient evidence
Behavioral Momentum Intervention	Organization of behavior expectations in a sequence in which low probability/preference behaviors are embedded in a series of high probability/preference behaviors to increase the occurrence of the low probability/preference behaviors	Banda & Kubina (2006) Davis, Brady, Hamilton, McEvoy & Williams (1994) Davis, Brady, Williams, & Hamilton (1992) Ducharme, Lucas, & Pontes (1994) Houlihan, Jacobson, & Brandon (1994) Jung, Sainato, & Davis (2008) Patel et al. (2007) Riviere, Becquet, Peltret, Facon, & Darcheville (2011) Romano & Roll (2000)	Insufficient number of total participants
Collaborative Coaching	Systematic consultation across years to promote achievement of IEP goals	Ruble, Dalrymple, & McGrew (2010)	Insufficient evidence
Cooperative Learning Groups	Academic learning tasks organized around joint activities and goals	Dugan et al. (1995)	Insufficient evidence
Direct Instruction	Instructional package involving student choral responses, explicit signal to cue student responses, correction procedures for incorrect or non-responses, modeling correct responses, independent student responses	Flores & Ganz (2007) Ganz & Flores (2009)	Only one research group
Exposure	Increasing (for accelerating behaviors) or decreasing (for decelerating behaviors) the stimulus intensity or conditions to promote the occurrence of the desired response	Ellis, Ala'i-Rosales, Glenn, Rosales-Ruiz, & Greenspoon (2006) Shabani & Fisher (2006) Wood, Wolery, & Kaiser (2009)	Insufficient evidence
Handwriting Without Tears	Multisensory activities promoting fine motor and writing skills	Carlson, McLaughlin, Derby, & Blecher (2009)	Insufficient evidence
Independent Work Systems	Instructional process that includes visually and spatial organized location, previously mastered work, clear specification of task(s), signal when work is finished, instructions for next activity	Bennett, Reichow, & Wolery (2011) Hume & Odom (2007) Mavropoulou, Papadopoulou, & Kakana (2011)	Insufficient evidence

Practice	Description	Evidence	Exclusion
Joint Attention-Symbolic Play Instruction	A combination of DTT and NI were employed to promote joint attention and symbolic play	Gulsrud, Kasari, Freeman, & Paparella (2007) Kasari, Freeman, & Paparella (2006) Kasari, Paparella, Freeman, & Jahromi (2008)	Only one research group
Music Intensity	Different levels of music volume used to affect vocal stereotypy	Lanovaz, Sladeczek, & Rapp (2011)	Insufficient evidence
Music Therapy	Songs and music used as a medium through which student's goals may be addressed	Kern & Aldridge (2006) Kern, Wakeford, & Aldridge (2007) Kern, Wolery, & Aldridge (2007)	Only one research group
Reciprocal Imitation Training	Therapist or teacher repeats the actions, vocalizations, or other behaviors of the student to promote student's imitation and other goals	Ingersoll (2010) Ingersoll (2012) Ingersoll & Lalonde (2010) Ingersoll, Lewis, & Kroman (2007)	Only one research group
Removal of Restraints	Gradual removal of restraints involving application of pressure to arm, shadowing	Jennett, Hagopian, & Beaulieu (2011)	Insufficient evidence
Schema-Based Strategy Instruction	Cognitive strategy for establishing mental representations to promote addition and subtraction	Rockwell, Griffin, & Jones (2011)	Insufficient evidence
Self-Regulated Strategy Development Writing Intervention	Instructional package involving explanation of strategy and self-management to teach writing skills	Delano (2007)	Insufficient evidence
Sensory Diet	Sensory based activities integrated into child routines to meet sensory needs	Fazlıoğlu & Baran (2008)	Insufficient evidence
Sensory Integration and Fine Motor Intervention	Therapeutic activities characterized by enhanced sensation, especially tactile, vestibular, and proprioceptive, active participation and adaptive interaction paired with individual fine motor instruction from OT	Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson (2011)	Insufficient evidence
Sentence-Combining Technique	Instructional package including teacher modeling, student practice, and worksheet to increase adjective use in writing	Rousseau, Krantz, Poulson, Kitson, & McClannahan (1994)	Insufficient evidence
Test Taking Strategy Instruction	Instructional package involving modeling, mnemonic devices, verbal practice sessions, controlled practice sessions, advanced practice sessions	Songlee, Miller, Tincani, Sileo, & Perkins (2008)	Insufficient evidence
Theory of Mind Training	Structured training and practice of using theory of mind skills that includes a parent component	Begeer, et al. (2011)	Insufficient evidence
Toilet Training	Modification of toilet training program developed by Arin and Fox (1971)	LeBlanc, Carr, Crossett, Bennett, & Detweiler (2005)	Insufficient evidence
Touch-Point Instruction	Tactile and number line materials used to introduce math and numeracy concepts	Cihak & Foust (2008) Fletcher, Boon, & Cihak (2010)	Insufficient evidence
Touch Therapy	Systematic touching or massage	Field, et al. (1997)	Insufficient evidence

Chapter 4
Discussion

THE CURRENT REVIEW updates and extends the work on evidence-based, focused intervention practices begun with an initial review completed in 2007 (Odom, Collet-Klingenberg, et al., 2010). In this chapter, we discuss the 27 EBPs identified in the current review and describe the differences between EBPs in the current and previous review. We examine the practice of combining EBPs into behavioral intervention packages in idiosyncratic ways that addresses specific participant outcomes and also describe interventions with some, but insufficient, evidence to be identified as an EBP. As with any review, it is important to identify limitations, which we acknowledge, and we also propose implications of the results of this review for practice and future research.

Evidence-Based Practices

In this review, 27 focused intervention practices meet the evidence-based criteria, as compared to 24 practices identified in the previous review (see Table 11). The current set includes six new EBP categories. Five of these categories, cognitive behavior interventions, exercise, modeling, scripting, and structured play groups are entirely new since the last review. They were supported by more recent research (1997–2011) in combination with studies published during the 1990-97 time period. The new technology-aided instruction and intervention practice reflects an expansion of the definition of technology interventions for students with ASD, which resulted in the previous categories of computer aided instruction and speech generating devices/VOCA being subsumed under this classification. In addition, more and different uses of technology have emerged (e.g., use of smart phone and tablet technology). Structured work systems, in the original list of EBPs, was not included in the current set of EBPs because the new methodological criteria eliminated some studies. However, the empirical support underlying structured work systems is highlighted in the list of practices noted as "Other Focused Intervention Practices Having Some Support," to be discussed in a subsequent section.

Table 11. Focused Intervention Practices from Previous and Current Review.

Previous Review: Evidence-Based Practices from 1997–2007	Current Review: Evidence-Based Practices from 1990–2011	Reason for Change
Antecedent-Based Interventions	Antecedent-Based Interventions	
	Cognitive Behavior Intervention	More accumulated evidence
Computer Aided Instruction		Expanded conceptualization (see Technology-Aided Instruction and Intervention)
Differential Reinforcement of Other Behaviors	Differential Reinforcement of Other Behaviors	
Discrete Trial Teaching	Discrete Trial Teaching	
	Exercise	More accumulated evidence
Extinction	Extinction	
Functional Behavior Assessment	Functional Behavior Assessment	
Functional Communication Training	Functional Communication Training	
	Modeling	More accumulated evidence
Naturalistic Intervention	Naturalistic Intervention	
Parent-Implemented Intervention	Parent-Implemented Intervention	
PECS	PECS	
Peer-Mediated Instruction and Intervention	Peer-Mediated Instruction and Intervention	
Pivotal Response Training	Pivotal Response Training	
Prompting	Prompting	
Reinforcement	Reinforcement	
Response Interruption/Redirection	Response Interruption/Redirection	
	Scripting	More accumulated evidence
Self-Management	Self-Management	
Social Narrative	Social Narrative	
Speech Generating Devices/VOCA		Expanded conceptualization (see Technology-Aided Instruction and Intervention)
Social Skills Training	Social Skills Training	
	Structured Play Group	More accumulated evidence
Structured Work Systems		More stringent criteria reduced previous evidence
Task Analysis	Task Analysis	
	Technology-Aided Instruction and Intervention	Expanded conceptualization (incorporated previous Computer Aided Instruction and Speech Generating Devices)
Time Delay	Time Delay	
Video Modeling	Video Modeling	
Visual Support	Visual Support	

Strength of Evidence

In this review, there was no attempt to calculate effect size, as would occur in a meta-analysis. Because the empirical support for interventions is derived from two different methodologies (i.e., group and SCD), effect size estimates from the two different designs generally have different meanings. For example, group design meta-analytic procedures usually consist of analyses between mean performances of groups in different experimental conditions whereas SCD analyses usually consist of within case comparisons in different experimental conditions. Even if the two approaches were consistent, researchers in the field have not reached agreement on the best approach for calculating effect size for SCD (Kratchowill et al., 2013).

The number of studies that support a given practice does not reflect the potency of the intervention, but does reflect the weight of the research evidence showing that the intervention is indeed effective. Fifteen of the EBPs have over 10 studies providing empirical support for the practice, and among those, the foundational applied behavior analysis techniques (e.g., prompting and reinforcement) have the most support. Antecedent-based interventions, differential reinforcement, and video modeling also have substantial support with over 25 studies supporting their efficacy. The number and variety of these replications speak to the relative strength of these EBPs.

Idiosyncratic Behavioral Intervention Package

A clear trend in the set of studies found in this review was the authors' selection of EBPs, most often applied behavior analysis techniques, that they used in combination to address a specific behavior problem or goal for the participant. For example, to teach two students with ASD recreational rock climbing skills, Kaplan-Reimer et al. (2011) employed stimulus fading (i.e., a form of antecedent-based intervention), errorless learning (i.e., a form of prompting), and positive reinforcement to create a behavioral intervention package. Other idiosyncratic behavioral intervention packages addressed problem behaviors (Strain et al., 2011). The idiosyncratic behavioral intervention packages were not classified as EBPs in this review, although the packages themselves were made up of EBPs. The rationale for not qualifying this group as an EBP is that the practices themselves are substantially different from one another, and none of the individual packages was replicated in subsequent studies to demonstrate that the package was other than applicable to the specific circumstances in which it was employed. These packages do demonstrate, however, the utility of the EBPs in addressing individual behavioral needs of children and youth with ASD.

Other Practices with Empirical Support

Some focused intervention practices with well-defined procedures were detected by this literature review but were not included as EBPs because they did not meet one or more of the specific criteria. A common reason for not meeting criteria was insufficient numbers of studies

documenting efficacy. For example, in Table 10, 16 practices were identified that had only one acceptable study supporting its efficacy, which is quite limited support. Other practices did have multiple studies but fell below the minimum number of studies required. For example, the efficacy of the structured work system intervention is documented by multiple studies (see Table 10) and was included as an EBP in the previous EBP review. However, with the methodological evaluation employed in this review, only three SCD studies met the criteria, which was less than the five SCD studies needed to be classified as an EBP. Similarly, music therapy was supported by three SCD studies, which was below the number needed for qualification as an EBP. One practice, behavioral momentum interventions, did have support from nine SCD studies; however, the total number of participants across the studies (16) did not meet the EBP qualification criteria (i.e., total of at least 20 participants across the SCD studies).

Other practices were also supported by multiple demonstrations of efficacy, but all the studies were conducted by one research group (i.e., efficacy needs to be replicated by more than one research group). The reciprocal imitation training (RIT) approach developed by Ingersoll and colleagues had a substantial and impressive set of studies documenting efficacy. For RIT, there were a sufficient number and variety of studies to be classified as an EBP, but all studies were conducted by the same research group. Similarly, the joint attention and symbolic play instruction practice has been studied extensively by Kasari and colleagues, but at the time of this review, the practice had not been replicated in an acceptable study by another research group.

A number of researchers designed interventions to promote academic outcomes, but because their procedures differed, the studies could not be grouped into a single EBP category. To promote reading and literacy skills, Ganz and Flores (2009) and Flores and Ganz (2007) used *Corrective Reading Thinking Basics.* To teach different writing skills, Rousseau et al. (1994) used a sentence combining technique; Delano (2007) used an instruction and self-management strategy; and Carlson et al. (2009) used a multisensory approach. For teaching different math skills, Cihak and colleagues (Cihak & Foust, 2008; Fletcher et al., 2010) employed touch point instruction and Rockwell et al. (2011) designed a schema-based instructional strategy. Test taking behavior, a particular problem for some children and youth with autism, was promoted through the use of modeling, mnemonic strategies, and different forms of practice to improve test taking performance by Songlee et al. (2008). Also, Dugan et al. (1995) employed a cooperative learning approach to promote engagement in a number of academic activities for children with ASD. This focus on academic outcomes has emerged primarily in post-2007 and appears to represent a trend in current and possibly future research.

It is important to repeat the cautionary note mentioned in the previous chapter about the amount of evidence available to demonstrate the efficacy of these essentially "undocumented"

interventions. All of these instructional and intervention practices fall below the EBP criteria established. Some do have substantial supportive evidence (e.g., multiple group or SCD studies), but the further an intervention practice is from the minimum criterion, the greater scrutiny and caution practitioners should exercise in their choice of the intervention.

Review Process

The current report updates a previous review of the literature conducted five years ago (Odom, Collet-Klingenberg, et al., 2010). With this report, we extend the review in several ways. First, we expand the coverage of the literature from 10 years (1997-2007) in the previous review to 21 years in the current review (1990-2011). As noted, limiting this review to the previous two decades is consistent with the procedures followed by other research synthesis organizations, such as the What Works Clearinghouse (http://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_procedures_v3_0_draft_standards_handbook.pdf).

The process followed in this review improved on the previous study evaluation criteria. First, a national panel of reviewers who were recruited and trained conducted the review of individual articles. In the previous review, the evaluations of individual studies were conducted by research staff within the NPDC project group. Second, the items for the article evaluation protocols were again based on the quality indicators developed by Gersten et al. (2005) for experimental and quasi-experimental design and Horner et al. (2005) for SCD, but the protocol developer also incorporated review criteria that has been used by the What Works Clearinghouse and other current review processes like the National Standards Project (http://www.nationalautismcenter.org/nsp/). The protocols were pilot tested by reviewers outside of the project evaluation team, and two national leaders in experimental group design and SCD provided a final review and feedback. Third, the articles included in the final review went through four screening and review levels before being incorporated into the final pool that was used to identify EBPs. In addition, after review categories were formed and supporting articles identified, evaluation team members conducted a final validity check to make sure the focused intervention procedures described in the method sections of articles were consistent with the category definitions within which they had been grouped to demonstrate empirical support. Although a systematic process for evaluating articles and summarizing empirical support for EBPs was followed in the previous review, the current review had greater scrutiny of individual articles. We propose that all of these added features improved the rigorous quality of the review process.

Limitations

As with nearly any review, we acknowledge that some limitations exist for this review. As noted, the review was only of studies published from 1990-2011. Two limitations exist regarding this timeframe. First, we acknowledge that we are missing studies that occurred before 1990, although one might expect early (i.e., pre-1990) studies of important and effective practices to have been replicated in publications over subsequent years. Second, because of the time required to conduct a review of a very large database and involve a national set of reviewers, there is a lag between the end date for a literature review (i.e., 2011) and the date on which the review is published (i.e., early 2014). Certainly, studies have been published in the interim that could have moved some of the "other practices" into the EBP classification.

The age range of participants in the studies reviewed was from birth to 22, or the typical school years (i.e., if one counts early intervention). This is important information for early intervention and service providers for school-age children and youth. The practices also have implications for older individuals with ASD, but the review falls short of specifically identifying EBPs for adults with ASD. Also, a major oversight was that we did not collect demographic information on the gender, race, and ethnicity of the participants of studies. Such information could have been a useful and important feature of this review. Last, in this review, we placed the emphasis on identifying the practices that are efficacious. It provides no information about practices that researchers documented as not having an effect or for practices that have deleterious effects.

Implications for Practice

The identification of focused intervention practices that have substantial evidence of efficacy provides the basis for designing comprehensive evidence-supported programs for children and youth with ASD. The distinction between evidence-based programs and evidence-supported programs is an important one (Cook & Cook, 2013). Developers of some comprehensive treatment models, such as the Lovaas Model (McEachin, Smith, & Lovaas, 1993) and the Early Start Denver Model (Dawson et al., 2010), have conducted randomized efficacy studies that provide empirical support for their program models, which would qualify them as *evidence-based* programs (Odom et al., in press). It is also possible for practitioners to design comprehensive programs for individual children with ASD in which they employ the EBPs identified in this or other reports. We have called these *technical eclectic* programs (Odom et al., 2012). They could be characterized as *evidence-supported* programs in that EBPs are integral features of the program model, but the efficacy of the entire program model has not been validated through a randomized controlled trial. Given that the *evidence-based* term has been used loosely in the past, it is important to be

specific about how the EBPs generated by this report fit with the entire movement toward basing instruction and intervention for children and youth with ASD on intervention science.

For practitioners to design a technical eclectic/evidence-supported program, there must be a process for linking student goals with EBPs (Cox et al., 2013; Odom et al., 2012). Such a process begins with the precise identification of individual goals and their statement in an objective and measurable manner. The content of the goal may be described as generating an outcome that fits into one of the 12 outcome areas shown as columns in Table 8 (previous chapter). From the matrix in Table 8, practitioners can identify the EBPs that have produced participant outcomes in the identified area. These could be considered as the EBPs that might work with that specific goal. Practitioners should, however, factor in other information in determining the intervention or teaching strategy for individual students. Other information includes students' previous history with the intervention approach, teachers' comfort with using the approach and previous training, feasibility of implementation in the intervention or instructional setting, and family preferences. In addition, the most important evidence supporting an EBP at the individual student level is the progress the student makes when the EBP is implemented. This places a great responsibility on the practitioner to implement the EBP with fidelity, collect data on child/youth performance, and use the data to evaluate the success of the EBP for meeting the child/youth's goal.

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Implications for Future Research

This review reveals gaps that exist in current knowledge about focused intervention practices for children and youth with ASD. The majority of the intervention studies over the last 20 years have been conducted with preschool-age and elementary school-age children. A clear need for the field is to expand the intervention literature up the age range to adolescents and young adults with ASD. This need was reflected in the small number of studies that addressed vocational and mental health outcomes, which may have greater relevance for adolescents and young adults. Similarly, fewer studies were identified for infants and toddlers with ASD and their families. While the evidence for comprehensive treatment programs for toddlers with ASD is expanding (Odom et al., in press), there is a need for moving forward the research agenda that addresses focused intervention practices for this age group. Early intervention providers and service providers for adolescents with ASD who build technical eclectic programs for children and youth with ASD now have to extrapolate from studies conducted with preschool and elementary-aged children with ASD. This practice is similar to the concept in psychopharmacology of off-label use of medications (i.e., those tested with adolescents and adults) for children with ASD. The need for

expanding the age range of intervention research has been identified by major policy initiative groups, such as the Interagency Autism Coordinating Committee (2012), and the prospect for future research in this area is bright.

Because of the demographics of ASD, much of the research has been conducted with boys and young men with ASD, and less is known about the effects of interventions and outcomes for girls and young women. In addition, while acknowledging that we did not collect information about race/ethnic/cultural diversity and underrepresented groups in this review, it is our informed opinion (from reading hundreds of studies), that most of the participants in the studies were either White-Caucasian or their race/ethnicity was not described. Similarly, information about children's or their families' socioeconomic status is rarely provided in studies. A needed feature of future intervention research is to include a more diverse set of participants than has occurred in the past and examine differences in treatment outcomes that may occur. This issue of diversity incorporates race/ethnicity but extends also to gender and socioeconomic diversity.

Conclusion

The current review conveys the state of the science in intervention practice for children and youth with ASD as well as the gaps in the science. With regard to the state of the science, as the volume and theoretical range of the literature has expanded, the number of EBPs has increased. This bodes well for a field that is searching for an empirical base for its practice and also for children and youth with ASD and their families, who may expect that advances in intervention science will lead to better outcomes. The prospect of better outcomes, however, is couched on the need for translating scientific results into intervention practices that service providers may access and providing professional development and support for implementing the practices with fidelity. Fortunately, the emerging field of implementation science may provide the needed guidance for such a translational process (Fixsen, Blase, Metz, & Van Dyke, 2013) and professional development models for teachers and service providers working with children and youth with ASD have begun to adopt an implementation science approach (Odom, Cox, & Brock, 2013). Such movement, from science to practice is a clear challenge and also an important next step for the field.

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Appendix A
Review Protocols

Group Design Quality Indicators **Instructions: Read each item and check the appropriate box.** **If you check "NO" at any time, the article will not be included as evidence for a practice.**		
Item	**YES**	**NO**
Does the study have experimental and control/comparative groups?		
Were appropriate procedures used to increase the likelihood that relevant characteristics of participants in the sample were comparable across conditions?		
Was their evidence for adequate reliability for the key outcome measures? And/or when relevant, was inter-observer reliability assessed and reported to be at an acceptable level?		
Were outcomes for capturing the intervention's effect measured at appropriate times (at least pre- and post-test)?		
Was the intervention described and specified clearly enough that critical aspects could be understood?		
Was the control/comparison condition(s) described?		
Were data analysis techniques appropriately linked to key research questions and hypotheses?		
Was attrition NOT a significant threat to internal validity?		
Does the research report statistically significant effects of the practice for individuals with ASD for at least one outcome variable?		
Were the measures of effect attributed to the intervention? (no obvious unaccounted confounding factors)		

Single Case Design Quality Indicators **Instructions: Read each item and check the appropriate box.** **If you check "NO" at any time, the article will not be included as evidence for a practice.**		
Item	**YES**	**NO**
Does the dependent variable align with the research question or purpose of the study?		
Was the dependent variable clearly defined such that another person could identify an occurrence or non-occurrence of the response?		
Does the measurement system align with the dependent variable and produce a quantifiable index?		
Did a secondary observer collect data on the dependent variable for at least 20% of sessions across conditions?		
Was mean interobserver agreement (IOA) 80% or greater OR kappa of .60 or greater?		
Is the independent variable described with enough information to allow for a clear understanding about the critical differences between the baseline and intervention conditions, or were references to other material used if description does not allow for a clear understanding?		
Was the baseline described in a manner that allows for a clear understanding of the differences between the baseline and intervention conditions?		
Are the results displayed in graphical format showing repeated measures for a single case (e.g., behavior, participant, group) across time?		
Do the results demonstrate changes in the dependent variable when the independent variable is manipulated by the experimenter at three different points in time or across three phase repetitions? *Alternating treatment designs require at least 4 repetitions of the alternating sequence.		

Appendix B
Intervention Fact Sheets

Antecedent-Based Intervention Fact Sheet

Brief Description

Antecedent-based interventions (ABI) include a variety of modifications that are made to the environment/context in an attempt to change or shape a student's behavior. ABI are typically implemented after conducting a functional behavior assessment which can assist in identifying both the function of an interfering behavior, along with environmental conditions that may have become linked to a behavior over time. Once factors in the environment that may be reinforcing interfering behavior have been identified, ABI are implemented to modify the environment or activity so that the factor no longer elicits the interfering behavior. Common ABI procedures include: 1) modifying educational activities, materials, or schedule (e.g., incorporating student interest), 2) incorporating student choice in educational activities/materials, 3) preparing students ahead of time for upcoming activities (e.g., priming), 4) varying the format, level of difficulty, or order of instruction during educational activities (e.g., varying high and low demand requests), 5) enriching the environment to provide additional cues or access to additional materials (e.g., visual cues, access to sensory stimuli), and 6) modifying prompting and reinforcement schedules and delivery (e.g., varying access to reinforcement prior to educational activities). ABI strategies often are used in conjunction with other evidence-based practices such as functional communication training, extinction, and reinforcement.

Qualifying Evidence

ABI meets evidence-based criteria with 32 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

ABI can be used effectively to address social, communication, behavior, play, school-readiness, academic, motor, and adaptive skills.

Research Studies Providing Evidence

Adcock, J., & Cuvo, A. J. (2009). Enhancing learning for children with autism spectrum disorders in regular education by instructional modifications. *Research in Autism Spectrum Disorders*, *3*(2), 319-328. doi: 10.1016/j.rasd.2008.07.004

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Cognitive Behavioral Intervention Fact Sheet

Brief Description

Cognitive behavioral intervention (CBI) is based on the belief that behavior is mediated by cognitive processes. Learners are taught to examine their own thoughts and emotions, recognize when negative thoughts and emotions are escalating in intensity, and then use strategies to change their thinking and behavior. These interventions tend to be used with learners who display problem behavior related to specific emotions or feelings, such as anger or anxiety. Cognitive behavioral interventions are often used in conjunction with other evidence-based practices including social narratives, reinforcement, and parent-implemented intervention.

Qualifying Evidence

CBI meets evidence-based criteria with 3 group design and 1 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for elementary school-age learners (6-11 years) to high school-age learners (15-18 years) with ASD.

Outcomes

CBI can be used effectively to address social, communication, behavior, cognitive, adaptive, and mental health outcomes.

Research Studies Providing Evidence

Drahota, A., Wood, J. J., Sze, K. M., & Van Dyke, M. (2011). Effects of cognitive behavioral therapy on daily living skills in children with high-functioning autism and concurrent anxiety disorders. *Journal of Autism and Developmental Disorders, 41*(3), 257-265. doi: 10.1007/s10803-010-1037-4

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Cognitive Behavioral Intervention Fact Sheet—suggested citation

Brock, M. E. (2013). *Cognitive behavioral intervention (CBI) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Differential Reinforcement of Alternative, Incompatible, or Other Behavior Fact Sheet

Brief Description

Differential reinforcement of alternative, incompatible, or other behavior (DRA/I/O) teaches new skills and increases behavior by providing positive/desirable consequences for behaviors or their absence that reduces the occurrence of an undesirable behavior, especially behaviors that interfere with the learner's learning, development, relationships, health and so on (e.g., tantrums, aggression, self-injury, stereotypic behavior). Through differential reinforcement the learner is reinforced for desired behaviors, while inappropriate behaviors are ignored. The learner is provided reinforcement when: a) the learner is engaging in a specific desired behavior other than the inappropriate behavior (DRA), b) the learner is engaging in a behavior that is physically impossible to do while exhibiting the inappropriate behavior (DRI), or c) the learner is not engaging in the interfering behavior (DRO). Differential reinforcement is often used with other evidence-based practices such as prompting to teach the learner behaviors that are more functional or incompatible with interfering behavior, with the overall goal of decreasing that interfering behavior.

Qualifying Evidence

DRA/I/O meets evidence-based criteria with 26 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to young adults (19-22 years) with ASD.

Outcomes

DRA/I/O can be used effectively to address social, communication, behavior, joint attention, play, school-readiness, academic, motor, and adaptive skills.

Research Studies Providing Evidence

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Differential Reinforcement of Alternative, Incompatible, or Other Behavior Fact Sheet—Suggested Citation

Kucharczyk, S. (2013). *Differential reinforcement of alternative, incompatible, or other behavior (DRA/I/O) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Bogin, J. & Sullivan, L. (2009). *Overview of differential reinforcement of other behaviors.* Sacramento: University of California at Davis School of Medicine, M.I.N.D. Institute, The National Professional Development Center on Autism Spectrum Disorders.

Discrete Trial Teaching
Fact Sheet

Brief Description

Discrete trial teaching (DTT) is a one-to-one instructional approach used to teach skills in a planned, controlled, and systematic manner. DTT is characterized by repeated, or massed, trials that have a definite beginning and end. Within DTT, the use of antecedents and consequences is carefully planned and implemented. The instructional trial begins when the adult presents a clear direction or stimulus, which elicits a target behavior. Positive praise and/or tangible rewards are used to reinforce desired skills or behaviors. Data collection is an important part of DTT as it provides teachers/practitioners with information about beginning skill level, progress and challenges, skill acquisition and maintenance, and generalization of learned skills or behaviors. Other practices that are used in DTT include task analysis, prompting, time delay, and reinforcement.

QualifyingEvidence

DTT meets evidence-based criteria with 13 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to elementary school-age learners (6-11 years) with ASD.

Outcomes

DTT can be used effectively to address social, communication, behavior, joint attention, school-readiness, academic, adaptive, and vocational skills.

Research Studies Providing Evidence

Goldsmith, T. R., LeBlanc, L. A., & Sautter, R. A. (2007). Teaching intraverbal behavior to children with autism. *Research in Autism Spectrum Disorders*, *1*(1), 1-13. doi: 10.1016/j.rasd.2006.07.001

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Simer, N., & Cuvo, A. J. (2009). Training vision screening behavior to children with developmental disabilities. *Research in Autism Spectrum Disorders*, *3*(2), 409-420. doi: 10.1016/j.rasd.2008.08.007

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Wynn, J. W., & Smith, T. (2003). Generalization between receptive and expressive language in young children with autism. *Behavioral Interventions*, *18*(4), 245-266. doi: 10.1002/bin.142

Discrete Trial Teaching Fact Sheet —suggested citation

Fleury, V. P. (2013). *Discrete trial teaching (DTT) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Bogin, J. (2008). *Overview of discrete trial training.* Sacramento: University of California at Davis School of Medicine, M.I.N.D. Institute, The National Professional Development Center on Autism Spectrum Disorders.

Exercise
Fact Sheet

Brief Description

Exercise (ECE) is a strategy that involves an increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behavior while increasing physical fitness and motor skills. With ECE, learners engage in a fixed period of programmed physical activity on a regular basis. ECE sessions often begin with warm-up exercises and end with cool-down activities and may include aerobic activities (e.g., jogging, jumping, swimming), strength training, and/or stretching that can take place indoors, outdoors, or at a swimming pool for aquatic exercise programs. ECE is often used in conjunction with prompting, reinforcement, and visual supports.

Qualifying Evidence

ECE meets evidence-based criteria with 3 group design and 3 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to middle school-age learners (12-14 years) with ASD.

Outcomes

ECE can be used effectively to address behavior, school-readiness, academic, and motor skills.

Research Studies Providing Evidence

Cannella-Malone, H. I., Tullis, C. A., & Kazee, A. R. (2011). Using antecedent exercise to decrease challenging behavior in boys with developmental disabilities and an emotional disorder. *Journal of Positive Behavior Interventions*, *13*(4), 230-239. doi: 10.1177/109830071140612

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Exercise Fact Sheet—suggested citation

Cox, A. W. (2013). *Exercise (ECE) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Extinction
Fact Sheet

Brief Description

Extinction (EXT) is a strategy based on applied behavior analysis that is used to reduce or eliminate a challenging behavior. The extinction procedure relies on accurately identifying the function of the behavior and the consequences that may be reinforcing its occurrence. The consequence that is believed to reinforce the occurrence of the target challenging behavior is removed or withdrawn, resulting in a decrease of the target behavior. An initial increase in the challenging behavior (often called an "extinction burst") is common before eventually being extinguished. Extinction should not be used in isolation. Other practices that are used in combination with extinction include differential reinforcement and functional behavior assessment.

Qualifying Evidence

EXT meets evidence-based criteria with 11 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to high school-age learners (15-18 years) with ASD.

Outcomes

EXT can be used effectively to address communication, behavior, school-readiness, and adaptive skills.

Research Studies Providing Evidence

Banda, D. R., McAfee, J. K., & Hart, S. L. (2009). Decreasing self-injurious behavior in a student with autism and Tourette syndrome through positive attention and extinction. *Child & Family Behavior Therapy*, *31*(2), 144-156. doi: 10.1080/07317100902910604

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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*(2), 309-313. doi: 10.1901/jaba.2009.42-309

Extinction Fact Sheet—suggested citation

Fleury, V. P. (2013). *Extinction (EXT) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Sullivan, L., & Bogin, J. (2010). *Overview of extinction.* Sacramento: University of California at Davis School of Medicine, M.I.N.D. Institute, The National Professional Development Center on Autism Spectrum Disorders.

Functional Behavior Assessment
Fact Sheet

Brief Description

Functional behavior assessment (FBA) is a systematic way of determining the underlying communicative function or purpose of a behavior so that an effective intervention plan can be developed. FBA consists of describing the interfering or problem behavior, identifying antecedent and consequent events that control the behavior, developing a hypothesis of the function of the behavior, and testing the hypothesis. Data collection is an important part of the FBA process. FBA is typically used to identify the causes of interfering behaviors such as self-injury, aggression towards others, or destructive behaviors and is usually followed by the creation and implementation of a behavior package to address the interfering behavior described.

Qualifying Evidence

FBA meets evidence-based criteria with 10 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

FBA can be used effectively to address communication, behavior, school-readiness, academic, and adaptive skills.

Research Studies Providing Evidence

Blair, K. C., Lee, I., Cho, S., & Dunlap, G. (2011). Positive behavior support through family-school collaboration for young children with autism. *Topics in Early Childhood Special Education, 31*, 22-36. doi: 10.1177/0271121410377510

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Dunlap, G., & Fox, L. (1999). A demonstration of behavioral support for young children with autism. *Journal of Positive Behavior Interventions*, *1*(2), 77-87. doi: 10.1177/109830079900100202

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McComas, J., Hoch, H., Paone, D., & El-Roy, D. (2000). Escape behavior during academic tasks: A preliminary analysis of idiosyncratic establishing operations. *Journal of Applied Behavior Analysis*, *33*(4), 479-493. doi: 10.1901/jaba.2000.33-479

O'Reilly, M. F., Edrisinha, C., Sigafoos, J., Lancioni, G., & Andrews, A. (2006). Isolating the evocative and abative effects of an establishing operation on challenging behavior. *Behavioral Interventions*, *21*(3), 195-204. doi: 10.1002/bin.215

Roberts-Gwinn, M. M., Luiten, L., Derby, K. M., Johnson, T. A., & Weber, K. (2001). Identification of competing reinforcers for behavior maintained by automatic reinforcement. *Journal of Positive Behavior Interventions*, *3*(2), 83-87. doi: 10.1177/109830070100300204

Functional Behavior Assessment Fact Sheet—suggested citation

Fettig, A. (2013). Functional behavior assessment (FBA) fact sheet. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Collet-Klingenberg, L. (2008). Overview of functional behavior assessment. Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Functional Communication Training Fact Sheet

Brief Description

Functional communication training (FCT) is a systematic practice to replace inappropriate behavior or subtle communicative acts with more appropriate and effective communicative behaviors or skills. FCT is preceded by an FBA to identify the function of an interfering behavior followed by teaching an appropriate communication skill that may serve the same purpose for the learner with ASD. FCT often includes differential reinforcement procedure in which an individual is taught an alternative response that results in the same class of reinforcement identified as maintaining problem behavior. Problem behavior is typically placed on extinction. The distinct component of FCT is that the alternative response is a recognizable form of communication (e.g., a vocalization, manual sign, Picture Exchange Communication System). FCT usually includes functional behavior assessment, differential reinforcement of alternative behavior, and extinction.

Qualifying Evidence

FCT meets evidence-based criteria with 12 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to high school-age learners (15-18 years) with ASD.

Outcomes

FCT can be used effectively to address social, communication, behavior, play, school-readiness, and adaptive outcomes.

Research Studies Providing Evidence

Brown, K. A., Wacker, D. P., Derby, K. M., Peck, S. M., Richman, D. M., Sasso, G. M., ... Harding, J. W. (2000). Evaluating the effects of functional communication training in the presence and absence of establishing operations. *Journal of Applied Behavior Analysis*, *33*(1), 53-71. doi: 10.1901/jaba.2000.33-53

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Volkert, V. M., Lerman, D. C., Call, N. A., & Trosclair-Lasserre, N. (2009). An evaluation of resurgence during treatment with functional communication training. *Journal of Applied Behavior Analysis*, *42*(1), 145-160. doi: 10.1901/jaba.2009.42-145

Functional Communication Training Fact Sheet—suggested citation

Fettig, A. (2013). *Functional communication training (FCT) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

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Franzone, E. (2009). Overview of functional communication training (FCT). Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Modeling
Fact Sheet

Brief Description

Modeling (MD) involves the demonstration of a desired target behavior that results in imitation of the behavior by the learner and that leads to the acquisition of the imitated behavior. MD is often combined with other strategies such as prompting and reinforcement.

Qualifying Evidence

MD meets evidence-based criteria with 1 group design and 4 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

MD can be used effectively to address social, communication, joint attention, play, school-readiness, academic, and vocational skills.

Research Studies Providing Evidence

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders*, *30*(6), 537-552. doi: 10.1023/A:1005635326276

Landa, R. J., Holman, K. C., O'Neill, A. H., & Stuart, E. A. (2011). Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: A randomized controlled trial. *Journal of Child Psychology and Psychiatry*, *52*(1), 13-21. doi: 10.1111/j.1469-7610.2010.02288.x

Matson, J. L., Box, M. L., & Francis, K. L. (1992). Treatment of elective mute behavior in two developmentally delayed children using modeling and contingency management. *Journal of Behavior Therapy and Experimental Psychiatry*, *23*(3), 221-229. doi: 10.1016/0005-7916(92)90039-L

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*(3), 205-218. doi: 10.1007/BF01046965

Schrandt, J. A., Townsend, D. B., & Poulson, C. L. (2009). Teaching empathy skills to children with autism. *Journal of Applied Behavior Analysis*, *42*(1), 17-32. doi: 10.1901/jaba.2009.42-17

Modeling Fact Sheet—suggested citation

Cox, A. W. (2013) *Modeling fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Naturalistic Intervention Fact Sheet

Brief Description

Naturalistic intervention (NI) is a collection of practices including environmental arrangement, interaction techniques, and strategies based on applied behavior analysis principles. These practices are designed to encourage specific target behaviors based on learners' interests by building more complex skills that are naturally reinforcing and appropriate to the interaction. Naturalistic intervention occurs within typical settings, activities, and/or routines in which the learner participates.

Qualifying Evidence

NI meets evidence-based criteria with 10 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to elementary school-age learners (6-11 years) with ASD.

Outcomes

NI can be used effectively to address social, communication, behavior, joint attention, play, and academic skills.

Research Studies Providing Evidence

Hancock, T. B., & Kaiser, A. P. (2002). The effects of trainer-implemented enhanced milieu teaching on the social communication of children with autism. *Topics in Early Childhood Special Education*, *22*(1), 39-54. doi: 10.1177/027112140202200104

Ingersoll, B., Dvortcsak, A., Whalen, C., & Sikora, D. (2005). The effects of a developmental, social—Pragmatic language intervention on rate of expressive language production in young children with autistic spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *20*(4), 213-222. doi: 10.1177/10883576050200040301

Koegel, L. K., Carter, C. M., & Koegel, R. L. (2003). Teaching children with autism self-initiations as a pivotal response. *Topics in Language Disorders*, *23*(2), 134-145. doi: 10.1097/00011363-200304000-00006

Koegel, R. L., Camarata, S., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998). Increasing speech intelligibility in children with autism. *Journal of Autism and Developmental Disorders*, *28*(3), 241-251. doi: 10.1023/A:1026073522897

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Kohler, F. W., Anthony, L. J., Steighner, S. A., & Hoyson, M. (2001). Teaching social interaction skills in the integrated preschool an examination of naturalistic tactics. *Topics in Early Childhood Special Education*, *21*(2), 93-103. doi: 10.1177/027112140102100203

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Olive, M. L., De la Cruz, B., Davis, T. N., Chan, J. M., Lang, R. B., O'Reilly, M. F., & Dickson, S. M. (2007). The effects of enhanced milieu teaching and a voice output communication aid on the requesting of three children with autism. *Journal of Autism and Developmental Disorders, 37*, 1505-1513. doi: 10.1007/s10803-006-0243-6

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Naturalistic Intervention Fact Sheet—suggested citation

Wong, C. (2013). *Naturalistic intervention (NI) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Franzone, E. (2009). *Overview of naturalistic intervention.* Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Parent-Implemented Intervention
Fact Sheet

Brief Description

Parent-implemented intervention (PII) includes programs in which parents are responsible for carrying out some or all of the intervention(s) with their own child. Parents are trained by professionals one-on-one or in group formats in home or community settings. Methods for training parents vary, but may include didactic instruction, discussions, modeling, coaching, or performance feedback. Parents may be trained to teach their child new skills, such as communication, play or self-help, and/or to decrease challenging behavior. Once parents are trained, they proceed to implement all or part of the intervention(s) with their child.

Qualifying Evidence

PII meets evidence-based criteria with 8 group design and 12 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to elementary school-age learners (6-11 years) with ASD.

Outcomes

PII can be used effectively to address social, communication, behavior, joint attention, play, cognitive, school-readiness, academic, and adaptive skills.

Research Studies Providing Evidence

Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: Pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology and Psychiatry*, *45*(8), 1420-1430. doi: 10.1111/j.1469-7610.2004.00338.x

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Jocelyn, L. J., Casiro, O. G., Beattie, D., Bow, J., & Kneisz, J. (1998). Treatment of children with autism: A randomized controlled trial to evaluate a caregiver-based intervention program in community day-care centers. *Journal of Developmental & Behavioral Pediatrics*, *19*(5), 326-334. doi: 10.1097/00004703-199810000-00002

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Krantz, P. J., MacDuff, M. T., & McClannahan, L. E. (1993). Programming participation in family activities for children with autism: Parents' use of photographic activity schedules. *Journal of Applied Behavior Analysis*, *26*(1), 137-138. doi: 10.1901/jaba.1993.26-137

Moran, D. R., & Whitman, T. L. (1991). Developing generalized teaching skills in mothers of autistic children. *Child & Family Behavior Therapy*, *13*(1), 13-37. doi: 10.1300/J019v13n01_02

Najdowski, A. C., Wallace, M. D., Reagon, K., Penrod, B., Higbee, T. S., & Tarbox, J. (2010). Utilizing a home-based parent training approach in the treatment of food selectivity. *Behavioral Interventions*, *25*(2), 89-107. doi: 10.1002/bin.298

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Rickards, A. L., Walstab, J. E., Wright-Rossi, R. A., Simpson, J., & Reddihough, D. S. (2007). A randomized, controlled trial of a home-based intervention program for children with autism and developmental delay. *Journal of Developmental & Behavioral Pediatrics, 28*(4), 308-316. doi: 10.1097/DBP.0b013e318032792e

Rocha, M. L., Schreibman, L., & Stahmer, A. C. (2007). Effectiveness of training parents to teach joint attention in children with autism. *Journal of Early Intervention*, *29*(2), 154-172. doi: 10.1177/105381510702900207

Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: A parent-mediated developmental model. *Journal of Autism and Developmental Disorders*, *37*(8), 1562-1575. doi: 10.1007/s10803-006-0290-z

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Stahmer, A. C., & Gist, K. (2001). The effects of an accelerated parent education program on technique mastery and child outcome. *Journal of Positive Behavior Interventions*, *3*(2), 75-82. doi: 10.1177/109830070100300203

Stiebel, D. (1999). Promoting augmentative communication during daily routines: A parent problem-solving intervention. *Journal of Positive Behavior Interventions*, *1*(3), 159-169. doi: 10.1177/109830079900100304

Symon, J. B. (2005). Expanding interventions for children with autism parents as trainers. *Journal of Positive Behavior Interventions*, *7*(3), 159-173. doi: 10.1177/10983007050070030501

Tarbox, J., Wallace, M. D., & Tarbox, R. S. (2002). Successful generalized parent training and failed schedule thinning of response blocking for automatically maintained object mouthing. *Behavioral Interventions*, *17*(3), 169-178. doi: 10.1002/bin.116

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Parent-Implemented Intervention Fact Sheet—suggested citation

Schultz, T. R. (2013). *Parent-implemented intervention (PII) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Hendricks, D. R. (2009). *Overview of parent-implemented intervention.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Peer-Mediated Instruction and Intervention Fact Sheet

Brief Description

Peer-mediated instruction and intervention (PMII) is used to teach typically developing peers ways to interact with and help learners with ASD acquire new behavior, communication, and social skills by increasing social opportunities within natural environments. With PMII, peers are systematically taught ways of engaging learners with ASD in social interactions in both teacher-directed and learner-initiated activities. Peers are paired or placed in cooperative learning groups that include at least one learner with ASD. PMII is a useful strategy for promoting positive transitions across settings.

Qualifying Evidence

PMII meets evidence-based criteria with 15 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to high school-age learners (15-18 years) with ASD.

Outcomes

PMII can be used effectively to address social, communication, joint attention, play, school-readiness, and academic skills.

Research Studies Providing Evidence

Carr, E. J. & Darcy, M. (1990). Setting generality of peer modeling in children with autism. *Journal of Autism and Developmental Disorders, 20*(1), 45-59. doi: 10.1007/BF02206856

Carter, E. W., Cushing, L. S., Clark, N. M., & Kennedy, C. H. (2005). Effects of peer support interventions on students' access to the general curriculum and social interactions. *Research and Practice for Persons with Severe Disabilities*, *30*(1), 15-25. doi: 10.2511/rpsd.30.1.15

Kamps, D. M., Barbetta, P. M., Leonard, B. R., & Delquadri, J. (1994). Classwide peer tutoring: An integration strategy to improve reading skills and promote peer interactions among students with autism and general education peers. *Journal of Applied Behavior Analysis*, *27*(1), 49-61. doi: 10.1901/jaba.1994.27-49

Kamps, D. M., Potucek, J., Lopez, A. G., Kravits, T., & Kemmerer, K. (1997). The use of peer networks across multiple settings to improve social interaction for students with autism. *Journal of Behavioral Education*, *7*(3), 335-357. doi: 10.1023/A:1022879607019

Kohler, F. W., Strain, P. S., Maretsky, S., & DeCesare, L. (1990). Promoting positive and supportive interactions between preschoolers: An analysis of group-oriented contingencies. *Journal of Early Intervention*, *14*(4), 327-341. doi: 10.1177/105381519001400404

Laushey, K. M., & Heflin, L. J. (2000). Enhancing social skills of kindergarten children with autism through the training of multiple peers as tutors. *Journal of Autism and Developmental Disorders*, *30*(3), 183-193. doi: 10.1023/A:1005558101038

Lee, S., Odom, S. L., & Loftin, R. (2007). Social engagement with peers and stereotypic behavior of children with autism. *Journal of Positive Behavior Interventions*, *9*(2), 67-79. doi: 10.1177/10983007070090020401

Mundschenk, N. A., & Sasso, G. M. (1995). Assessing sufficient social exemplars for students with autism. *Behavioral Disorders*, *21*(1), 62-78.

Nelson, C., McDonnell, A. P., Johnston, S. S., Crompton, A., & Nelson, A. R. (2007). Keys to play: A strategy to increase the social interactions of young children with autism and their typically developing peers. *Education and Training in Developmental Disabilities*, *42*(2), 165-181.

Odom, S. L. (1991). Reducing teacher prompts in peer-mediated interventions for young children with autism. *The Journal of Special Education*, *25*(1), 26-43. doi: 10.1177/002246699102500103

Owen-DeSchryver, J. S., Carr, E. G., Cale, S. I., & Blakeley-Smith, A. (2008). Promoting social interactions between students with autism spectrum disorders and their peers in inclusive school settings. *Focus on Autism and Other Developmental Disabilities*, *23*(1), 15-28. doi: 10.1177/1088357608314370

Petursdottir, A. L., McComas, J., McMaster, K., & Horner, K. (2007). The effects of scripted peer tutoring and programming common stimuli on social interactions of a student with autism spectrum disorder. *Journal of Applied Behavior Analysis*, *40*(2), 353-357. doi: 10.1901/jaba.2007.160-05

Sainato, D. M., Goldstein, H., & Strain, P. S. (1992). Effects of self-evaluation on preschool children's use of social interaction strategies with their classmates with autism. *Journal of Applied Behavior Analysis*, *25*(1), 127-141.

Sasso, G. M., Mundschenk, N. A., Melloy, K. J., & Casey, S. D. (1998). A comparison of the effects of organismic and setting variables on the social interaction behavior of children with developmental disabilities and autism. *Focus on Autism and Other Developmental Disabilities*, *13*(1), 2-16.

Trembath, D., Balandin, S., Togher, L., & Stancliffe, R. J. (2009). Peer-mediated teaching and augmentative and alternative communication for preschool-aged children with autism. *Journal of Intellectual and Developmental Disability*, *34*(2), 173-186. doi: 10.1080/13668250902845210

Peer-Mediated Instruction and Intervention Fact Sheet—suggested citation

Fettig, A. (2013). *Peer-mediated instruction and intervention (PMII) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J. (2008). *Overview of peer-mediated instruction and intervention for children and youth with autism spectrum disorders.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Picture Exchange Communication System
Fact Sheet

Brief Description

The Picture Exchange Communication System (PECS) is used to teach learners to communicate in a social context. Using PECS, learners are initially taught to give a picture of a desired item to a communicative partner in exchange for the item. There are six phases of PECS instruction: (1) "how" to communicate, (2) distance and persistence, (3) picture discrimination, (4) sentence structure, (5) responsive requesting, and (6) commenting.

Qualifying Evidence

PECS meets evidence-based criteria with 2 group design and 4 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to middle school-age learners (12-14 years) with ASD.

Outcomes

PECS can be used effectively to address social, communication, and joint attention skills.

Research Studies Providing Evidence

Ali, E., MacFarland, S. Z., & Umbreit, J. (2011). Effectiveness of combining tangible symbols with the Picture Exchange Communication System to teach requesting skills to children with multiple disabilities including visual impairment. *Education and Training in Autism and Developmental Disabilities*, *46*(3), 425-435.

Angermeier, K., Schlosser, R. W., Luiselli, J. K., Harrington, C., & Carter, B. (2008). Effects of iconicity on requesting with the Picture Exchange Communication System in children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *2*(3), 430-446. doi: 10.1016/j.rasd.2007.09.004

Carr, D., & Felce, J. (2007). The effects of PECS teaching to Phase III on the communicative interactions between children with autism and their teachers. *Journal of Autism and Developmental Disorders*, *37*(4), 724-737. doi: 10.1007/s10803-006-0203-1

Dogoe, M. S., Banda, D. R., & Lock, R. H. (2010). Acquisition and generalization of the Picture Exchange Communication System behaviors across settings, persons, and stimulus classes with three students with autism. *Education and Training in Autism and Development Disabilities*, *45*(2), 216-229.

Howlin, P., Gordon, R. K., Pasco, G., Wade, A., & Charman, T. (2007). The effectiveness of Picture Exchange Communication System (PECS) training for teachers of children with autism: A pragmatic, group randomised controlled trial. *Journal of Child Psychology and Psychiatry*, *48*(5), 473-481. doi: 10.1111/j.1469-7610.2006.01707.x

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Picture Exchange communication System Fact Sheet—suggested citation

Wong, C. (2013). *Picture Exchange Communication System (PECS) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Collet-Klingenberg, L. (2008). *Overview of Picture Exchange Communication System (PECS) for children and youth with autism spectrum disorders.* Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Pivotal Response Training
Fact Sheet

Brief Description

Pivotal response training (PRT) is a naturalistic intervention based on the principles of applied behavior analysis (ABA) to teach learners with autism spectrum disorders (ASD). PRT builds on learner initiative and interests, and is particularly effective for developing communication, language, play, and social behaviors. PRT was developed to create a more efficient and effective intervention by enhancing pivotal learning variables: motivation, responding to multiple cues, self-management, and self-initiations of social interactions. According to theory, these skills are pivotal because they are the foundational skills upon which learners with ASD can make widespread and generalized improvements in many other areas. Key procedures include child choice, reinforcement of attempts, incorporation of maintenance tasks, and direct/natural reinforcers contingent on appropriate behavior.

Qualifying Evidence

PRT meets evidence-based criteria with 1 group design and 7 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to middle school-age learners (12-14 years) with ASD.

Outcomes

PRT can be used effectively to address social, communication, joint attention, and play skills.

Research Studies Providing Evidence

Harper, C. B., Symon, J. B., & Frea, W. D. (2008). Recess is time-in: Using peers to improve social skills of children with autism. *Journal of Autism and Developmental Disorders*, *38*(5), 815-826. doi: 10.1007/s10803-007-0449-2

Koegel, R. L., & Frea, W. D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *Journal of Applied Behavior Analysis*, *26*(3), 369-377. doi: 10.1901/jaba.1993.26-369

Kuhn, L. R., Bodkin, A. E., Devlin, S. D., & Doggett, R. A. (2008). Using pivotal response training with peers in special education to facilitate play in two children with autism. *Education and Training in Developmental Disabilities*, *43*(1), 37-45.

Nefdt, N., Koegel, R., Singer, G., & Gerber, M. (2010). The use of a self-directed learning program to provide introductory training in pivotal response treatment to parents of children with autism. *Journal of Positive Behavior Interventions*, *12*(1), 23-32. doi: 10.1177/1098300709334796

Pierce, K., & Schreibman, L. (1997). Multiple peer use of pivotal response training to increase social behaviors of classmates with autism: Results from trained and untrained peers. *Journal of Applied Behavior Analysis*, *30*(1), 157-160. doi: 10.1901/jaba.1997.30-157

Robinson, S. E. (2011). Teaching paraprofessionals of students with autism to implement pivotal response treatment in inclusive school settings using a brief video feedback training package. *Focus on Autism and Other Developmental Disabilities, 26*, 105-118. doi: 10.1177/1088357611407063

Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of Autism and Developmental Disorders*, *25*(2), 123-141. doi: 10.1007/BF02178500

Pivotal Response Training Fact Sheet—suggested citation

Wong, C. (2013). *Pivotal response training (PRT) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Vismara, L. A., & Bogin, J. (2009). *Overview of pivotal response training.* Sacramento: University of California at Davis School of Medicine, M.I.N.D. Institute, The National Professional Development Center on Autism Spectrum Disorders.

Prompting
Fact Sheet

Brief Description

Prompting (PP) procedures include any help given to learners that assist them in using a specific skill. Verbal, gestural, or physical assistance is given to learners to assist them in acquiring or engaging in a targeted behavior or skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill. These procedures are often used in conjunction with other evidence-based practices including time delay and reinforcement or are part of protocols for the use of other evidence-based practices such as pivotal response training, discrete trial teaching, and video modeling. Thus, prompting procedures are considered foundational to the use of many other evidence-based practices.

Qualifying Evidence

PP meets evidence-based criteria with 1 group design and 32 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

PP can be used effectively to address social, communication, behavior, joint attention, play, school-readiness, academic, motor, adaptive, and vocational skills.

Research Studies Providing Evidence

Akmanoglu, N., & Batu, S. (2004). Teaching pointing to numerals to individuals with autism using simultaneous prompting. *Education and Training in Developmental Disabilities*, *39*(4), 326-336.

Anderson, J., & Le, D. D. (2011). Abatement of intractable vocal stereotypy using an overcorrection procedure. *Behavioral Interventions*, *26*(2), 134-146. doi: 10.1002/bin.326

Barton, E. E., & Wolery, M. (2010). Training teachers to promote pretend play in young children with disabilities. *Exceptional Children*, *77*(1), 85-106.

Batchelder, A., McLaughlin, T. F., Weber, K. P., Derby, K. M., & Gow, T. (2009). The effects of hand-over-hand and a dot-to-dot tracing procedure on teaching an autistic student to write his name. *Journal of Developmental and Physical Disabilities*, *21*(2), 131-138. doi: 10.1007/s10882-009-9131-2

Birkan, B., McClannahan, L. E., & Krantz, P. J. (2007). Effects of superimposition and background fading on the sight-word reading of a boy with autism. *Research in Autism Spectrum Disorders*, *1*(2), 117-125. doi: 10.1016/j.rasd.2006.08.003

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Cihak, D. F., & Grim, J. (2008). Teaching students with autism spectrum disorder and moderate intellectual disabilities to use counting-on strategies to enhance independent purchasing skills. *Research in Autism Spectrum Disorders*, *2*(4), 716-727.

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Prompting Fact Sheet—suggested citation

Cox, A. W. (2013) *Prompting (PP) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J., & Wolery, M. (2009). *Overview of prompting*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Reinforcement
Fact Sheet

Brief Description

Reinforcement (R+) is used to teach new skills and to increase behavior. Reinforcement establishes the relationship between the learner's behavior/use of skill and the consequence of that behavior/skill. This relationship is only reinforcing if the consequence increases the likelihood that the learner performs that behavior/skill. Reinforcement can be positive or negative. Positive reinforcement is the delivery of a reinforcer (i.e., something that the learner desires which may be tangible, edible, activity-based, interest-based, and so on) after the learner does the target skill or behavior. Positive reinforcement can also be implemented in the format of a token economy program. Token economy programs systematically give learners access to tokens when targeted behaviors/skills are used. These tokens are exchanged for desired objects or activities that reinforce the learners' use of that behavior/skill. Negative reinforcement is the removal of an object or activity that the learner does not want (e.g., taking a break after finishing a set of math problems) when the learner does the identified behavior or skill. Reinforcement is a foundational evidence-based practice in that it is almost always used in conjunction with other evidence-based practices (e.g., prompting, pivotal response training, discrete trial teaching, functional communication training).

Qualifying Evidence

R+ meets evidence-based criteria with 43 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

R+ can be used effectively to address social, communication, behavior, joint attention, play, cognitive, school-readiness, academic, motor, adaptive, and vocational skills.

Research Studies Providing Evidence

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Reinforcement Fact Sheet—suggested citation

Kucharczyk, S. (2013). *Reinforcement (R+) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J. (2009). *Overview of reinforcement.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Response Interruption/Redirection Fact Sheet

Brief Description

Response interruption/redirection (RIR) involves the introduction of a prompt, comment, or other distractors when an interfering behavior is occurring that is designed to divert the learner's attention away from the interfering behavior and results in its reduction. Specifically, RIR is used predominantly to address behaviors that are repetitive, stereotypical, and/or self-injurious. RIR often is implemented after a functional behavior assessment (FBA) has been conducted to identify the function of the interfering behavior. RIR is particularly useful with persistent interfering behaviors that occur in the absence of other people, in a number of different settings, and during a variety of tasks. These behaviors often are not maintained by attention or escape. Instead, they are more likely maintained by sensory reinforcement and are often resistant to intervention attempts. RIR is particularly effective with sensory-maintained behaviors because learners are interrupted from engaging in interfering behaviors and redirected to more appropriate, alternative behaviors.

Qualifying Evidence

RIR meets evidence-based criteria with 10 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to young adults (19-22 years) with ASD.

Outcomes

RIR can be used effectively to address social, communication, behavior, play, school-readiness, and adaptive skills.

Research Studies Providing Evidence

Ahearn, W. H., Clark, K. M., MacDonald, R. P., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis*, *40*(2), 263-275. doi: 10.1901/jaba.2007.30-06

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Lang, R., O'Reilly, M., Sigafoos, J., Lancioni, G. E., Machalicek, W., Rispoli, M., & White, P. (2009). Enhancing the effectiveness of a play intervention by abolishing the reinforcing value of stereotypy: A pilot study. *Journal of Applied Behavior Analysis*, *42*(4), 889-894. doi: 10.1901/jaba.2009.42-889

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Rapp, J. T., Vollmer, T. R., & Hovanetz, A. N. (2006). Evaluation and treatment of swimming pool avoidance exhibited by an adolescent girl with autism. *Behavior Therapy, 36*(1), 101-105. doi: 10.1016/S0005-7894(05)80058-9

Response Interruption/Redirection Fact Sheet—suggested citation

Boyd, B., & Wong, C. (2013). *Response interruption/redirection (RIR) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J. (2009). *Overview of response interruption/redirection*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Scripting
Fact Sheet

Brief Description

Scripting (SC) involves presenting learners with a verbal and/or written description about a specific skill or situation that serves as a model for the learner. The main rationale of SC is to help learners anticipate what may occur during a given activity and improve their ability to appropriately participate in the activity. SC are practiced repeatedly before the skill is used in the actual situation. When learners are able to use the scripts successfully in actual situations, the script should be systematically faded. SC is often used in conjunction with modeling, prompting, and reinforcement.

Qualifying Evidence

SC meets evidence-based criteria with 1 group design and 8 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to high school-age learners (15-18 years) with ASD.

Outcomes

SC can be used effectively to address social, communication, joint attention, play, cognitive, school-readiness, and vocational skills.

Research Studies Providing Evidence

Brown, J. L., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (2008). Using script fading to promote natural environment stimulus control of verbal interactions among youths with autism. *Research in Autism Spectrum Disorders*, *2*(3), 480-497. doi: 10.1016/j.rasd.2007.08.006

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Scripting Fact Sheet—suggested citation

Fleury, V. P. (2013). Scripting (SC) fact sheet. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Self-Management
Fact Sheet

Brief Description

Self-management (SM) is an intervention package that teaches learners to independently regulate their own behavior. Self-management involves teaching learners to discriminate between appropriate and inappropriate behaviors, accurately monitor and record their own behaviors, and reinforce themselves for behaving appropriately. Although learners may initially require adult support to accurately record behaviors and provide self-reinforcement, this support is faded over time. Self-management is often used in conjunction with other evidence-based practices including modeling, video modeling, and visual supports.

Qualifying Evidence

SM meets evidence-based criteria with 10 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to young adults (19-22 years) with ASD.

Outcomes

SM can be used effectively to address social, communication, behavior, play, school-readiness, academic, and vocational skills.

Research Studies Providing Evidence

Ganz, J. B., & Sigafoos, J. (2005). Self-monitoring: Are young adults with MR and autism able to utilize cognitive strategies independently? *Education and Training in Developmental Disabilities*, *40*(1), 24-33.

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Newman, B. (1995). Self-management of schedule following in three teenagers with autism. *Behavioral Disorders*, *20*(3), 190-96.

Shogren, K. A., Lang, R., Machalicek, W., Rispoli, M. J., & O'Reilly, M. (2011). Self- versus teacher management of behavior for elementary school students with Asperger syndrome: Impact on classroom behavior. *Journal of Positive Behavior Interventions*, *13*(2), 87-96. doi: 10.1177/1098300710384508

Stahmer, A. C., & Schreibman, L. (1992). Teaching children with autism appropriate play in unsupervised environments using a self-management treatment package. *Journal of Applied Behavior Analysis*, *25*(2), 447-459. doi: 10.1901/jaba.1992.25-447

Self-Management Fact Sheet—suggested citation

Brock, M. E. (2013). *Self-management (SM) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J., & Busick, M. (2009). *Overview of self-management*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Social Narratives
Fact Sheet

Brief Description

Social narratives (SN) are interventions that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding. They are aimed at helping learners adjust to changes in routine and adapt their behaviors based on the social and physical cues of a situation, or to teach specific social skills or behaviors. Social narratives are individualized according to learner needs and typically are quite short, perhaps including pictures or other visual aids. Usually written in first person from the perspective of the learner, social narratives include sentences that detail the situation, provide suggestions for appropriate learner responses, and describe the thoughts and feelings of other people involved in the situation.

Qualifying Evidence

SN meets evidence-based criteria with 17 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to high school-age learners (15-18 years) with ASD.

Outcomes

SN can be used effectively to address social, communication, behavior, joint attention, play, school-readiness, academic, and adaptive skills.

Research Studies Providing Evidence

Barry, L. M., & Burlew, S. B. (2004). Using social stories to teach choice and play skills to children with autism. *Focus on Autism and Other Developmental Disabilities*, *19*(1), 45-51. doi: 10.1177/10883576040190010601

Bock, M. A. (2007). The impact of social-behavioral learning strategy training on the social interaction skills of four students with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, *22*(2), 88-95. doi: 10.1177/10883576070220020901

Campbell, A., & Tincani, M. (2011). The power card strategy: Strength-based intervention to increase direction following of children with autism spectrum disorder. *Journal of Positive Behavior Interventions*, *13*(4), 240-249. doi: 10.1177/1098300711400608

Chan, J. M., & O'Reilly, M. F. (2008). A Social Stories™ intervention package for students with autism in inclusive classroom settings. *Journal of Applied Behavior Analysis*, *41*(3), 405-409. doi: 10.1901/jaba.2008.41-405

Chan, J. M., O'Reilly, M. F., Lang, R. B., Boutot, E. A., White, P. J., Pierce, N., & Baker, S. (2011). Evaluation of a Social Stories™ intervention implemented by pre-service teachers for students with autism in general education settings. *Research in Autism Spectrum Disorders*, *5*(2), 715-721. doi: 10.1016/j.rasd.2010.08.005

Delano, M., & Snell, M. E. (2006). The effects of social stories on the social engagement of children with autism. *Journal of Positive Behavior Interventions*, *8*(1), 29-42. doi: 10.1177/10983007060080010501

Dodd, S., Hupp, S. D., Jewell, J. D., & Krohn, E. (2008). Using parents and siblings during a social story intervention for two children diagnosed with PDD-NOS. *Journal of Developmental and Physical Disabilities*, *20*(3), 217-229. doi: 10.1007/s10882-007-9090-4

Hung, L. C., & Smith, C. S. (2011). Autism in Taiwan: Using Social Stories™ to decrease disruptive behaviour. *The British Journal of Development Disabilities*, *57*(112), 71-80. doi: 10.1179/096979511798967197

Ivey, M. L., Heflin, L. J., & Alberto, P. (2004). The use of social stories to promote independent behaviors in novel events for children with PDD-NOS. *Focus on Autism and Other Developmental Disabilities*, *19*(3), 164-176. doi: 10.1177/10883576040190030401

Kuttler, S., Myles, B. S., & Carlson, J. K. (1998). The use of social stories to reduce precursors to tantrum behavior in a student with autism. *Focus on Autism and Other Developmental Disabilities*, *13*(3), 176-182. doi: 10.1177/108835769801300306

Lorimer, P. A., Simpson, R. L., Myles, B. S., & Ganz, J. B. (2002). The use of social stories as a preventative behavioral intervention in a home setting with a child with autism. *Journal of Positive Behavior Interventions*, *4*(1), 53-60. doi: 10.1177/109830070200400109

Mancil, G. R., Haydon, T., & Whitby, P. (2009). Differentiated effects of paper and computer-assisted Social Stories™ on inappropriate behavior in children with autism. *Focus on Autism and Other Developmental Disabilities*, *24*(4), 205-215. doi: 10.1177/1088357609347324

Ozdemir, S. (2008). The effectiveness of social stories on decreasing disruptive behaviors of children with autism: Three case studies. *Journal of Autism and Developmental Disorders*, *38*(9), 1689-1696. doi: 10.1007/s10803-008-0551-0

Sansosti, F. J., & Powell-Smith, K. A. (2006). Using social stories to improve the social behavior of children with Asperger syndrome. *Journal of Positive Behavior Interventions*, *8*(1), 43-57.

Scattone, D. (2008). Enhancing the conversation skills of a boy with Asperger's disorder through Social Stories™ and video modeling. *Journal of Autism and Developmental Disorders*, *38*(2), 395-400. doi: 10.1007/s10803-007-0392-2

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Schneider, N., & Goldstein, H. (2010). Using social stories and visual schedules to improve socially appropriate behaviors in children with autism. *Journal of Positive Behavior Interventions*, *12*(3), 149-160. doi: 10.1177/1098300709334198

Social Narratives Fact Sheet—suggested citation

Wong, C. (2013). *Social narratives (SN) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Collet-Klingenberg, L., & Franzone, E. (2008). *Overview of social narratives*. Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Social Skills Training
Fact Sheet

Brief Description

Social skills training (SST) involves group or individual instruction designed to teach learners to appropriately interact with typically developing peers. Most social skills meetings include instruction on basic concepts, role-playing or practice, and feedback to help learners acquire and practice communication, play, or social skills to promote positive interactions with peers.

Qualifying Evidence

SST meets evidence-based criteria with 7 group design and 8 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

SST can be used effectively to address social, communication, behavior, play, and cognitive skills.

Research Studies Providing Evidence

Belchic, J. K., & Harris, S. L. (1994). The use of multiple peer exemplars to enhance the generalization of play skills to the siblings of children with autism. *Child & Family Behavior Therapy, 16*(2), 1-25. doi: 10.1300/J019v16n02_01

Chin, H. Y., & Bernard-Opitz, V. (2000). Teaching conversational skills to children with autism: Effect on the development of a theory of mind. *Journal of Autism and Developmental Disorders, 30*(6), 569-583. doi: 10.1023/A:1005639427185

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Gonzalez-Lopez, A., & Kamps, D. M. (1997). Social skills training to increase social interactions between children with autism and their typical peers. *Focus on autism and other developmental disabilities*, *12*(1), 2-14. doi: 10.1177/108835769701200101

Koenig, K., White, S. W., Pachler, M., Lau, M., Lewis, M., Klin, A., & Scahill, L. (2010). Promoting social skill development in children with pervasive developmental disorders: A feasibility and efficacy study. *Journal of Autism and Developmental Disorders*, *40*(10), 1209-1218. doi: 10.1007/s10803-010-0979-x

Kroeger, K. A., Schultz, J. R., & Newsom, C. (2007). A comparison of two group-delivered social skills programs for young children with autism. *Journal of Autism and Developmental Disorders*, *37*(5), 808-817. doi: 10.1007/s10803-006-0207-x

Laugeson, E. A., Frankel, F., Mogil, C., & Dillon, A. R. (2009). Parent-assisted social skills training to improve friendships in teens with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(4), 596-606. doi: 10.1007/s10803-008-0664-5

Laushey, K. M., Heflin, L. J., Shippen, M., Alberto, P. A., & Fredrick, L. (2009). Concept mastery routines to teach social skills to elementary children with high functioning autism. *Journal of Autism and Developmental Disorders*, *39*(10), 1435-1448. doi: 10.1007/s10803-009-0757-9

Leaf, J. B., Taubman, M., Bloomfield, S., Palos-Rafuse, L., Leaf, R., McEachin, J., & Oppenheim, M. L. (2009). Increasing social skills and pro-social behavior for three children diagnosed with autism through the use of a teaching package. *Research in Autism Spectrum Disorders*, *3*(1), 275-289. doi: 10.1016/j.rasd.2008.07.003

Lopata, C., Thomeer, M. L., Volker, M. A., Toomey, J. A., Nida, R. E., Lee, G. K., ... Rodgers, J. D. (2010). RCT of a manualized social treatment for high-functioning autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *40*(11), 1297-1310. doi: 10.1007/s10803-010-0989-8

Owens, G., Granader, Y., Humphrey, A., & Baron-Cohen, S. (2008). LEGO® therapy and the social use of language programme: An evaluation of two social skills interventions for children with high functioning autism and Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*(10), 1944-1957. doi: 10.1007/s10803-008-0590-6

Ozonoff, S., & Miller, J. N. (1995). Teaching theory of mind: A new approach to social skills training for individuals with autism. *Journal of Autism and Developmental Disorders*, *25*(4), 415-433. doi: 10.1007/BF02179376

Palmen, A., Didden, R., & Arts, M. (2008). Improving question asking in high-functioning adolescents with autism spectrum disorders: Effectiveness of small-group training. *Autism*, *12*(1), 83-98. doi: 10.1177/1362361307085265

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Yang, N. K., Schaller, J. L., Huang, T. A., Wang, M. H., & Tsai, S. F. (2003). Enhancing appropriate social behaviors for children with autism in general education classrooms: An analysis of six cases. *Education and Training in Developmental Disabilities*, *38*(4), 405-416.

Social Skills Training Fact Sheet—suggested citation

Fettig, A. (2013). *Social skills training (SST) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Collet-Klingenberg, L. (2009). *Overview of social skills groups*. Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Structured Play Groups
Fact Sheet

Brief Description

Structured play groups (SPG) are interventions using small groups to teach a broad range of outcomes. SPG activities are characterized by their occurrences in a defined area and with a defined activity, specific selection of typically developing peers to be in the group, clear delineation of theme and roles by adult leading the, and prompting or scaffolding as needed to support the students' performance related to the goals of the activity.

Qualifying Evidence

SPG meets evidence-based criteria with 2 group design and 2 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for elementary school-age learners (6-11 years) with ASD.

Outcomes

SPG can be used effectively to address social, communication, behavior, play, school-readiness, and academic skills.

Research Studies Providing Evidence

Legoff, D. B., & Sherman, M. (2006). Long-term outcome of social skills intervention based on interactive LEGO© play. *Autism*, *10*(4), 317-329. doi: 10.1177/1362361306064403

Loftin, R. L., Odom, S. L., & Lantz, J. F. (2008). Social interaction and repetitive motor behaviors. *Journal of Autism and Developmental Disorders*, *38*(6), 1124-1135. doi: 10.1007/s10803-007-0499-5

Owens, G., Granader, Y., Humphrey, A., & Baron-Cohen, S. (2008). LEGO® therapy and the social use of language programme: An evaluation of two social skills interventions for children with high functioning autism and Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*(10), 1944-1957. doi: 10.1007/s10803-008-0590-6

Wolfberg, P. J., & Schuler, A. L. (1993). Integrated play groups: A model for promoting the social and cognitive dimensions of play in children with autism. *Journal of Autism and Developmental Disorders*, *23*(3), 467-489. doi: 10.1007/BF01046051

Structured Play Groups Fact Sheet—suggested citation

Odom, S. L. (2013). *Structured play groups (SPG) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Task Analysis
Fact Sheet

Brief Description

Task analysis (TA) involves breaking a complex or "chained" behavioral skill into smaller components in order to teach a skill. The learner can be taught to perform individual steps of the chain until the entire skill is mastered (also called "chaining"). Other practices, such as reinforcement, video modeling, or time delay, should be used to facilitate learning of the smaller steps. As the smaller steps are mastered, the learner becomes more and more independent in his/her ability to perform the larger skill.

Qualifying Evidence

TA meets evidence-based criteria with 8 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (age 3–5 years) to middle school-age learners (12–14 years) with ASD.

Outcomes

TA can be used effectively to address social, communication, joint attention, academic, motor, and adaptive skills.

Research Studies Providing Evidence

Browder, D. M., Trela, K., & Jimenez, B. (2007). Training teachers to follow a task analysis to engage middle school students with moderate and severe developmental disabilities in grade-appropriate literature. *Focus on Autism and Other Developmental Disabilities*, *22*(4), 206-219. doi: 10.1177/10883576070220040301

Martins, M. P., & Harris, S. L. (2006). Teaching children with autism to respond to joint attention initiations. *Child & Family Behavior Therapy, 28*(1), 51-68. doi: 10.1300/J019v28n01_04

Morse, T. E., & Schuster, J. W. (2000). Teaching elementary students with moderate intellectual disabilities how to shop for groceries. *Exceptional Children*, *66*(2), 273-288.

Parker, D., & Kamps, D. (2011). Effects of task analysis and self-monitoring for children with autism in multiple social settings. *Focus on Autism and Other Developmental Disabilities*, *26*(3), 131-142. doi: 10.1177/1088357610376945

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Tekin-Iftar, E., & Birkan, B. (2010). Small group instruction for students with autism: General case training and observational learning. *The Journal of Special Education, 44*(1), 50-63. doi: 10.1177/0022466908325219

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Yılmaz, I., Konukman, F., Birkan, B., Ozen, A., Yanardagù, M., & Camursoy, I. (2010). Effects of constant time delay procedure on the Halliwick's method of swimming rotation skills for children with autism. *Education and Training in Autism and Developmental Disabilities*, 45, 124-135.

Task analysis Fact Sheet—suggested citation

Fleury, V. P. (2013). *Task analysis (TA) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Franzone, E. (2009). *Overview of task analysis*. Madison: University of Wisconsin, Waisman Center, The National Professional Development Center on Autism Spectrum Disorders.

Technology-Aided Instruction and Intervention Fact Sheet

Brief Description

Technology-aided instruction and intervention (TAII) are those in which technology is the central feature of an intervention that supports the goal or outcome for the student. Technology is defined as "any electronic item/equipment/application/or virtual network that is used intentionally to increase/maintain, and/or improve daily living, work/productivity, and recreation/leisure capabilities of adolescents with autism spectrum disorders" (Odom, Thompson, et al., 2013). TAII incorporates a broad range of devices, such as speech-generating devices, smart phones, tables, computed-assisted instructional programs, and virtual networks. The common features of these interventions are the technology itself (as noted) and instructional procedures for learning to use the technology or supporting its use in appropriate contexts.

Qualifying Evidence

TAII meets evidence-based criteria with 9 group design and 11 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to young adults (19-22 years) with ASD.

Outcomes

TAII can be used effectively to address social, communication, behavior, joint attention, cognitive, school-readiness, academic, motor, adaptive, and vocational skills.

Research Studies Providing Evidence

Beaumont, R., & Sofronoff, K. (2008). A multicomponent social skills intervention for children with Asperger syndrome: The Junior Detective Training Program. *Journal of Child Psychology and Psychiatry*, *49*(7), 743-753. doi: 10.1111/j.1469-7610.2008.01920.x

Choi, H., O'Reilly, M., Sigafoos, J., & Lancioni, G. (2010). Teaching requesting and rejecting sequences to four children with developmental disabilities using augmentative and alternative communication. *Research in Developmental Disabilities: A Multidisciplinary Journal, 31*(2), 560-567. doi: 10.1016/j.rasd.2010.08.005

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Faja, S., Aylward, E., Bernier, R., & Dawson, G. (2007). Becoming a face expert: A computerized face-training program for high-functioning individuals with autism spectrum disorders. *Developmental Neuropsychology*, *33*(1), 1-24. doi: 10.1080/87565640701729573

Golan, O., Ashwin, E., Granader, Y., McClintock, S., Day, K., Leggett, V., & Baron-Cohen, S. (2010). Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotional faces. *Journal of Autism and Developmental Disorders*, *40*(3), 269-279. doi: 10.1007/s10803-009-0862-9

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Hopkins, I. M., Gower, M. W., Perez, T. A., Smith, D. S., Amthor, F. R., Wimsatt, F. C., & Biasini, F. J. (2011). Avatar assistant: Improving social skills in students with an ASD through a computer-based intervention. *Journal of Autism and Developmental Disorders*, *41*(11), 1543-1555. doi: 10.1007/s10803-011-1179-z

Kagohara, D. M., van der Meer, L., Achmadi, D., Green, V. A., O'Reilly, M. F., Mulloy, A., ... & Sigafoos, J. (2010). Behavioral intervention promotes successful use of an iPod-based communication device by an adolescent with autism. *Clinical Case Studies*, *9*(5), 328-338. doi: 10.1177/1534650110379633

Kodak, T., Fisher, W. W., Clements, A., & Bouxsein, K. J. (2011). Effects of computer-assisted instruction on correct responding and procedural integrity during early intensive behavioral intervention. *Research in Autism Spectrum Disorders*, *5*(1), 640-647.

Mechling, L. C., Gast, D. L., & Cronin, B. A. (2006). The effects of presenting high-preference items, paired with choice, via computer-based video programming on task completion of students with autism. *Focus on Autism and Other Developmental Disabilities*, *21*(1), 7-13. doi: 10.1177/10883576060210010201

Mechling, L. C., Gast, D. L., & Seid, N. H. (2009). Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *39*(10), 1420-1434. doi: 10.1007/s10803-009-0761-0

Mechling, L. C., & Savidge, E. J. (2011). Using a personal digital assistant to increase completion of novel tasks and independent transitioning by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *41*(6), 687-704. doi: 10.1007/s10803-010-1088-6

Mineo, B. A., Ziegler, W., Gill, S., & Salkin, D. (2009). Engagement with electronic screen media among students with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(1), 172-187. doi: 10.1007/s10803-008-0616-0

Moore, M., & Calvert, S. (2000). Brief report: Vocabulary acquisition for children with autism: Teacher or computer instruction. *Journal of Autism and Developmental Disorders*, *30*(4), 359-362. doi: 10.1023/A:1005535602064

Myles, B. S., Ferguson, H., & Hagiwara, T. (2007). Using a personal digital assistant to improve the recording of homework assignments by an adolescent with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, *22*(2), 96-99. doi: 10.1177/10883576070220021001

Richter, S. & Test, D. (2011). Effects of multimedia social stories on knowledge of adult outcomes and opportunities among transition-aged youth with significant cognitive disabilities. *Education and Training in Autism and Developmental Disabilities, 46*(3), 410-424.

Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. *Autism*, *5*(3), 299-316. doi: 10.1177/1362361301005003007

Soares, D. A., Vannest, K. J., & Harrison, J. (2009). Computer aided self-monitoring to increase academic production and reduce self-injurious behavior in a child with autism. *Behavioral Interventions*, *24*(3), 171-183.

Stromer, R., Mackay, H. A., Howell, S. R., McVay, A. A., & Flusser, D. (1996). Teaching computer-based spelling to individuals with developmental and hearing disabilities: Transfer of stimulum control to writing tasks. *Journal of Applied Behavior Analysis*, *29*(1), 25-42. doi: 10.1901/jaba.1996.29-25

Whalen, C., Moss, D., Ilan, A. B., Vaupel, M., Fielding, P., Macdonald, K., ... Symon, J. (2010). Efficacy of TeachTown: Basics computer-assisted intervention for the intensive comprehensive autism program in Los Angeles unified school district. *Autism*, *14*(3), 179-197. doi: 10.1177/1362361310363282

Technology-Aided Instruction and Intervention Fact Sheet—suggested citation

Odom, S. L. (2013). *Technology-aided instruction and intervention (TAII) fact sheet*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Time Delay
Fact Sheet

Brief Description

Time delay (TD) is a practice used to systematically fade the use of prompts during instructional activities. With this procedure, a brief delay is provided between the initial instruction and any additional instructions or prompts. The evidence-based research focuses on two types of time delay procedures: progressive and constant. With *progressive time delay*, the adult gradually increases the waiting time between an instruction and any prompts that might be used to elicit a response from a learner with ASD. For example, a teacher provides a prompt immediately after an instruction when a learner with ASD is initially learning a skill. As the learner becomes more proficient at using the skill, the teacher gradually increases the waiting time between the instruction and the prompt. In *constant time delay*, a fixed amount of time is always used between the instruction and the prompt as the learner becomes more proficient at using the new skill. Time delay is always used in conjunction with a prompting procedure (e.g., least-to-most prompting, simultaneous prompting, graduated guidance).

Qualifying Evidence

TD meets evidence-based criteria with 12 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for preschoolers (3-5 years) to young adults (19-22 years) with ASD.

Outcomes

TD can be used effectively to address social, communication, behavior, joint attention, play, cognitive, school-readiness, academic, motor, and adaptive skills.

Research Studies Providing Evidence

Collins, B. C., Hager, K. L., & Creech Galloway, C. (2011). Addition of functional content during core content instruction with students with moderate disabilities. *Education and Training in Autism and Developmental Disabilities*, *46*(1), 22-39.

Ingenmey, R., & Houten, R. (1991). Using time delay to promote spontaneous speech in an autistic child. *Journal of Applied Behavior Analysis*, *24*(3), 591-596. doi: 10.1901/jaba.1991.24-591

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), 1-17. doi: 10.1901/jaba.2010.43-1

Leung, J. P. (1994). Teaching spontaneous requests to children with autism using a time delay procedure with multi-component toys. *Journal of Behavioral Education*, *4*(1), 21-31. doi: 10.1007/BF01560506

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Miller, C., Collins, B. C., & Hemmeter, M. L. (2002). Using a naturalistic time delay procedure to teach nonverbal adolescents with moderate-to-severe mental disabilities to initiate manual signs. *Journal of Developmental and Physical Disabilities*, *14*(3), 247-261. doi: 10.1023/A:1016072321661

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Rogers, L., Hemmeter, M. L., & Wolery, M. (2010). Using a constant time delay procedure to teach foundational swimming skills to children with autism. *Topics in Early Childhood Special Education*, *30*(2), 102-111. doi: 10.1177/0271121410369708

Taylor, B. A., & Harris, S. L. (1995). Teaching children with autism to seek information: acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis*, *28*(1), 3-14. doi: 10.1901/jaba.1995.28-3

Venn, M. L., Wolery, M., Werts, M. G., Morris, A., DeCesare, L. D., & Cuffs, M. S. (1993). Embedding instruction in art activities to teach preschoolers with disabilities to imitate their peers. *Early Childhood Research Quarterly*, *8*(3), 277-294. doi: 10.1016/S0885-2006(05)80068-7

Time Delay Fact Sheet—suggested citation

Fleury, V. P. (2013). *Time delay (TD) fact sheet.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Adapted from:

Neitzel, J. (2009). *Overview of time delay.* Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, The National Professional Development Center on Autism Spectrum Disorders.

Video Modeling
Fact Sheet

Brief Description

Video modeling (VM) is a method of instruction that uses video recording and display equipment to provide a visual model of the targeted behavior or skill. The model is shown to the learner, who then has an opportunity to perform the target behavior, either in the moment or at a later point in time. Types of video modeling include basic video modeling, video self-modeling, point-of-view video modeling, and video prompting. *Basic video modeling* is the most common and involves recording someone besides the learner engaging in the target behavior or skill. *Video self-modeling* is used to record the learner displaying the target skill or behavior and may involve editing to remove adult prompts. *Point-of-view video modeling* is when the target behavior or skill is recorded from the perspective of what the learner will see when he or she performs the response. *Video prompting* involves breaking the behavior into steps and recording each step with incorporated pauses during which the learner may view and then attempt a step before viewing and attempting subsequent steps. Video prompting can be implemented with other, self, or point-of-view models. Video modeling strategies have been used in isolation and also in conjunction with other intervention components such as prompting and reinforcement strategies.

Qualifying Evidence

VM meets evidence-based criteria with 1 group design and 31 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19–22) years with ASD.

Outcomes

VM can be used effectively to address social, communication, behavior, joint attention, play, cognitive, school-readiness, academic, motor, adaptive, and vocational skills.

Research Studies Providing Evidence

Akmanoglu, N., & Tekin-Iftar, E. (2011). Teaching children with autism how to respond to the lures of strangers. *Autism*, *15*(2), 205-222. doi: 10.1177/1362361309352180

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Visual Supports
Fact Sheet

Brief Description

Visual supports (VS) are concrete cues that provide information about an activity, routine, or expectation and/or support skill demonstration. Visual supports can provide assistance across activity and setting, and can take on a number of forms and functions. These include but are not limited to: photographs, icons, drawings, written words, objects, environmental arrangement, schedules, graphic organizers, organizational systems, and scripts. Visual supports are commonly used to: 1) organize learning environments, 2) establish expectations around activities, routines, or behaviors (e.g., visual schedules, visual instructions, structured work systems, scripts, power cards), 3) provide cues or reminders (e.g., conversation and initiation cues, choice making supports, visual timers, finished box), and 4) provide preparation or instruction (e.g., video priming, video feedback).

Qualifying Evidence

Visual supports meet evidence-based criteria with 18 single case design studies.

Ages

According to the evidence-based studies, this intervention has been effective for toddlers (0-2 years) to young adults (19-22 years) with ASD.

Outcomes

Visual supports can be used effectively to address social, communication, behavior, play, cognitive, school-readiness, academic, motor, and adaptive skills.

Research Studies Providing Evidence

Angell, M. E., Nicholson, J. K., Watts, E. H., & Blum, C. (2011). Using a multicomponent adapted power card strategy to decrease latency during interactivity transitions for three children with developmental disabilities. *Focus on Autism and Other Developmental Disabilities*, *26*(4), 206-217. doi: 10.1177/1088357611421169

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Murdock, L. C., & Hobbs, J. Q. (2011). Tell me what you did today: A visual cueing strategy for children with ASD. *Focus on Autism and Other Developmental Disabilities*, *26*(3), 162-172. doi: 10.1177/1088357611405191

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