The Effect of Sensory-Based Interventions on Communication Outcomes in Children: A Systematic Review

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Speech–language pathologists (SLPs) commonly treat children presenting with diverse and complex developmental issues, including those involving difficulties with sensory processing or integration. Interventions designed to address these difficulties can take various forms, but most are sensory-based and involve providing enriched or specialized sensory input to the child. Regardless of form, many of these interventions tend to be either based on or derived from the principles of sensory integration theory.

Sensory integration was conceived as "the organization of sensations for use" (Ayres & Robbins, 2005, p. 5); however, the focus is primarily on the vestibular, tactile, and proprioceptive systems (Mauer, 1999). According to sensory integration theory, the successful processing of sensory information through these systems provides a basis for higher-order learning (e.g., language, academic skills; Hoehn & Baumeister, 1994). Through a cumulative and continuous process of sensory intake, sensory organization and integration, response, and feedback, the brain interacts with the environment and collects information for further learning (Reynolds, 2010). Sensory integration theory posits that effective neuro-processing of sensory information is an essential underpinning to the learning process (Ayres & Robbins, 2005). Any disruption in the neurological processing or organization of sensory information from these vestibular, tactile, and proprioceptive systems may result in behavioral or learning difficulties.

Sensory integration disorder has been identified and studied in a number of clinical populations, including children with learning disabilities (Ayres, 1972), language disorders (Ayres & Mailloux, 1981), autism spectrum disorder (Case-Smith & Bryan, 1999), and intellectual disabilities (Montgomery & Richter, 1977). In addition to establishing the theory behind sensory integration, Ayres also put forth the concept of sensory integration treatment (Ayers, 1972; Ayres & Robbins, 2005). Sensory integration treatment (SIT) does not directly address specific skill development; instead, SIT was designed to normalize the underlying sensory system by providing controlled sensory stimulation. Enhancing effective neurological processing and building a foundation for improved learning and function by developing the various underlying sensory systems (e.g., vestibular, proprioceptive) are the primary goals

of SIT. Key principles of SIT consist of active engagement and participation in treatment by the child and the inclusion of activities that are child-directed or follow the child's lead, as well as scaffolding of treatment activities to provide a precise challenge and elicit an adaptive response from the child (Schaaf & Miller, 2005). It is suggested that, through these responses, the child develops helpful strategies and increases the ability to process effectively sensory information in typical situations.

Various systematic reviews have explored the effects of SIT, specifically in children. Several reviews pertaining to children with autism spectrum disorders (ASD) indicated there was insufficient or inconclusive evidence to determine the effectiveness of SIT with this population (Case-Smith & Arbesman, 2008; National Autism Center, 2009; Parr, 2010; Tochel, 2003; Warren et al., 2011). One review (Ospina et al., 2008) stated that the evidence for sensory-motor interventions (which included SIT) was too limited or inconsistent to promote their clinical use, and another (Baranek, 2002) noted that, while SITs appeared to be safe and anecdotally have shown some benefit, the research findings are mixed. Further, Lang et al. (2012) concluded that SIT did not have a consistent positive effect as a treatment for ASD. Reviews pertaining to children with developmental coordination disorders (Hillier, 2007; Mandich, Polatajko, Macnab, & Miller, 2001; Pless & Carlsson, 2000) have reported more consistent findings. Hillier (2007) determined that SIT frequently yielded positive effects, but urged caution when interpreting the findings because a number of negative or nil effects of SIT were also reported. Pless and Carlsson (2000) compared treatment based on a general abilities approach, a specific skills approach, and SIT. The authors reported that SIT produced the smallest effect of the three and that therapists should not expect to directly improve academic, language, cognitive, or motor outcomes through SIT. Comparable findings were noted in another review (Mandich et al., 2001), which concluded that SIT yielded similar results to other interventions in improving motor skills with this population. A recent systematic review of SIT in children with sensory processing or integration difficulties concluded that, although additional methodologically sound research is needed to replicate the findings, there is a trend toward positive findings to support SIT (May-Benson & Koomar, 2010).

Other systematic reviews on SIT have included studies in children and adults. An early meta-analysis (Ottenbacher, 1982) investigated SIT compared to a control group in children and adults with clinical conditions such as learning disabilities, intellectual disabilities, aphasia, and those at risk for reading disorders. Findings indicated empirical support for SIT with the largest effects noted in motor outcomes and more modest effects reported for language measures. As an update, Hoehn and Baumeister (1994) reviewed the relevant research published since Ottenbacher (1982). Their inclusion criteria were similar, with the exception that included participants were limited to children with learning disabilities. The authors concluded that few facilitative effects of SIT were found and questioned the value of SIT as an appropriate treatment for this clinical population. Vargas and Camilli (1999) also conducted a meta-analysis of SIT research that included children and adults with various diagnoses (e.g., learning disability, motor delay, intellectual disability, aphasia). Their results showed that, compared to no treatment, SIT had a significant effect on psychoeducational and motor outcomes but not on behavior, language, or sensory-perceptual outcomes. Additionally, no statistically significant differences were noted between SIT and alternative treatments on any of the targeted outcomes. Last, Leong and Carter (2008) conducted a review of research published on SIT since 1994 and determined that, due to the inadequate evidence to support the efficacy of SIT, its use is unjustified outside of research contexts.

Other sensory-based interventions are those that incorporate specific sensory activities but do not employ the additional key components of SIT (e.g., active child engagement, scaffolding of activities). These may consist of treatments such as touch therapy, massage, vestibular stimulation, or weighted vests. Some systematic reviews have analyzed these, primarily in children with ASD. One review (Case-Smith & Arbesman, 2008) indicated massage could improve attention and ameliorate maladaptive behaviors, stereotypic movements, and hyperactivity. Two other reviews reported that massage was an emerging evidence-based treatment (National Autism Center, 2009; Young, Corea, Kimani, & Mandell, 2010). Another review (Lee, Kim, & Ernst, 2011) concluded there was limited evidence supporting massage as an effective treatment for the symptoms of ASD in children. However, given the

methodological limitations of the included studies, no firm conclusions could be made. The use of weighted vests in children with ASD has also been investigated. Stephenson and Carter (2009) found that weighted vests provided no consistent positive effects and could not be recommended for clinical use, whereas Morrison (2007) concluded that the evidence to support the use of weighted vests in students with ASD was limited. The effect of another sensory activity, vestibular stimulation, on a variety of children (e.g., typically developing, at-risk, those with diagnosed disabilities) was examined in a single systematic review. Ottenbacher and Petersen (1983) indicated that vestibular stimulation had a small effect on physiological and language/cognitive outcomes and a large effect on motor, reflex, visual, and auditory measures. In regards to sensory stimulation procedures, Horn (1991) reported that the evidence for children with neuromotor delays was too limited to determine the effectiveness of the approach. Finally, one review (Botts, Hershfeldt, & Christensen-Sandfort, 2008) explored the effects of a multisensory environment (i.e., Snoezelen®) on behaviors applicable to school settings and determined that, due to the paucity of research, these environments did not meet the standards of evidence-based practice.

Another sensory-based treatment, auditory integration treatment (AIT), is also not completely aligned with SIT ideology, but is designed to systematically address auditory sensation deficits. AIT consists of presenting electronically modified music or speech with random attenuation of frequencies and intensities to alleviate hearing hyper- or hypo-sensitivities or atypical perceptions of sounds (American Speech-Language-Hearing Association [ASHA], 2004). Examples of AIT and sound therapies that include aspects of AIT are Berard, Tomatis, and Somonas Sound Therapy. These approaches have been investigated with a number of different populations, including those with ASD, attention deficit disorder, intellectual disabilities, or auditory processing disorders (Bettison, 1996; Madell, 1999; Yencer, 1998; Zollweg, Vance, & Palm, 1997). It has been theorized that sound sensitivities in these and other populations can lead to a variety of difficulties—specifically in behavior, attention, and communication (ASHA, 2004). AIT is believed to ameliorate these underlying sensitivities and lead to improvements in

skills, such as sound modulation, attention, language, and social interaction (National Research Council, 2001).

Systematic reviews examining AIT have focused predominately on individuals with ASD. The majority of these reviews cited inconclusive, insufficient, or inconsistent evidence to determine the treatment effectiveness of AIT (Case-Smith & Arbesman, 2008; National Autism Center, 2009; Ospina et al., 2008; Parr, 2010; Sinha, Silove, Wheeler, & Williams, 2004; Warren et al., 2011). Other reviews have concluded that AIT is generally not supported by the evidence (National Research Council, 2001), unlikely to be provide any benefit over unprocessed music (Tochel, 2003), supported by lower-level evidence (Rossignol, 2009), or is an unestablished intervention (Young et al., 2010). Another review (Baranek, 2002) indicated that possible adverse effects of AIT should be carefully considered against any potential benefits. Also, Gilmor (1999) examined the use of the Tomatis method of AIT on children with learning and communication disorders and found positive effects for linguistic, psychomotor, social, and cognitive outcomes. No effect was noted for auditory outcomes.

Citing a lack of controlled systematic research, several professional organizations, including ASHA, the American Academy for Audiology (AAA), the American Academy of Pediatrics (AAP), and the Educational Audiology Association (EAA), have stipulated that AIT should be considered an experimental procedure (AAA, 2010; ASHA, 2004, EAA, 1996) or is unwarranted outside of research protocols (AAP, 1998). Recent anecdotal reports increasingly indicate that SLPs and audiologists are being asked to incorporate SIT or sensory-based activities into their interventions. These requests have prompted SLPs to seek guidance from ASHA as to the appropriateness and effectiveness of these treatments (as implemented by SLPs) on communication outcomes. As part of its commitment to evidence-based practice, ASHA's National Center for Evidence-Based Practice (N-CEP) has been conducting evidence-based systematic reviews (EBSRs) on specific clinical topics nominated by the membership. In 2011, based on member interest, N-CEP initiated an EBSR to determine the state and quality of the evidence on the effects of SIT or sensory-based interventions. Though previous SIT and

other sensory-based intervention reviews reported no or minimal effectiveness on language habilitation (e.g., Ottenbacher, 1982; Pless & Carlsson, 2000), no review highlighted the nature of communication outcomes associated with sole provision of those therapies by, or in collaboration with, an SLP. Additionally, given the complementary relationship between speech-language pathology and audiology services as well as the scope of SIT and other sensory-based interventions, any studies of audiologists' involvement in providing those therapies are also of interest. Therefore, the specific clinical question addressed by this review was: What is the effect of sensory-based interventions by an SLP or audiologist (either directly or in collaboration) on communication outcomes (i.e., speech, language, or hearing) in preschool or school-aged children?

Method

To identify relevant literature, a systematic search of the peer-reviewed published literature was conducted from October 2011 to August 2012 using 27 electronic databases (Appendix A). Databases were searched using a comprehensive strategy developed by identifying key words, controlled vocabulary, Medical Subject Headings (MeSH), and free text related to sensory integration, sensory-based treatments, auditory integration, and communication (Appendix A). Additional studies were identified by reviewing the reference lists of full-text articles, reviews, meta-analyses, and guidelines. To be included in this EBSR, a study had to be written in English, published in a peer-reviewed journal between January 1970 and July 2012, and provide original data addressing the targeted clinical question. Studies were excluded if they provided mixed treatments (that were not controlled for through the research design) or examined the effects of oral sensory stimulation on speech or swallowing as these interventions were addressed in previous reviews (Arvedson, Clark, Lazarus, Schooling, & Frymark, 2010; McCauley, Strand, Lof, Schooling, & Frymark, 2009).

The systematic search yielded 734 abstracts. Two reviewers independently evaluated the citations and identified 104 as meeting the initial inclusion criteria, with 86% agreement. Upon full-text review of

the 104 citations, 100 more were eliminated for violating one or more of the inclusion criteria. A total of four articles were included in the final analysis.

Each included study was assessed for methodological rigor by two independent evaluators using a critical appraisal tool developed by ASHA (Cherney, Patterson, Raymer, Frymark, & Schooling, 2008; Mullen, 2007). Studies were evaluated in eight areas: protocol description, subject comparability/description, assessor blinding, sampling/allocation, treatment fidelity, significance, precision, and intention-to-treat analysis when applicable (Appendix B). Level of agreement of appraisal ratings between the two evaluators was 94%. Any disagreements were documented and resolved via discussion and consensus. Because a primary aim of this EBSR was to determine the state and quality of the evidence, all studies, regardless of methodological rigor, were included in the review. In addition to the quality appraisal information, key study variables describing the participants (e.g., age, diagnosis), treatment (e.g., intervention provided, frequency and intensity of services), and outcomes were extracted and summarized.

When appropriate and not indicated in the study, magnitude of treatment effect (Cohen's *d*) and corresponding confidence intervals were calculated (Cohen, 1960).

Results

Table 1 details the participants, interventions, and outcomes of the included studies. The four studies had a total of 82 participants ranging in age from 18 months to 14 years. Most participants (63%, 52/82) were male. Medical or SLP/audiologist diagnoses varied and included ASD, sensory impairment, communication/language disorder, learning disability, developmental delay, intellectual disability, auditory processing disorder, and attention deficit/hyperactivity disorder. The studies examined speech-language pathology treatment in conjunction with a range of other interventions, including vestibular stimulation (Kantner, Kantner, & Clark, 1982), auditory integration training (Monville & Nelson, 1994; Tatum, Oelfke, & McCauley, 2004), and comprehensive sensory integration treatment (Fallon, Mauer, & Neukirch, 1994).

Sensory Integration and Sensory-Based Treatments

In Kanter et al. (1982), children with intellectual disabilities received either vestibular stimulation in combination with an individualized speech and language program, an individualized speech and language program only, or general speech and language stimulation. Each of the three groups made significant gains on one or more of the subtests of the Porch Index of Communicative Ability in Children (PICAC; Porch, 1974). Children who received both vestibular stimulation and speech-language pathology treatment demonstrated significant gains in three subtests (i.e., overall communication, general communication, and verbal communication). Those receiving speech-language pathology treatment only or general speech and language stimulation significantly improved on four subtests (i.e., overall communication, general communication, visual communication, and gestural communication) and one subtest (i.e., general communication) respectively. Despite these within-group, pretest/posttest differences, there was no significant post-treatment difference in scores between the groups on the PICAC. Effect sizes for the various subscales ranged from -0.38 to 0.16 and were also considered non-significant because the corresponding CIs contained the null value (i.e., zero).

Fallon et al. (1994) investigated different interventions with three distinct groups. A group of children with a variety of disabilities (e.g., developmental delay, pervasive developmental disorder) were identified as having either sensory and language impairment (SI/LI) or language impairment only (LI). The SI/LI group received sensory integration treatment and individualized SLP treatment, and the LI group received individualized speech-language pathology treatment only. A third group of typically developing children who served as language-age matched controls received no intervention. Within group changes from pre- to post-treatment were reported for mean length of utterance (MLU), the language subtest of the Hawaii Early Learning Profile (HELP; Furuno et al., 1988), and the communication subtest of the Batelle Developmental Inventory (BDI; Newborg, Stock, & Wnek, 1984). Only the SI/LI group demonstrated significant gains ($p \leq .01$) on one of the communication outcome measures (i.e., BDI). Although the range of effect sizes ($d = 0.58 – 1.59$) across the measures were medium to large, the

corresponding CIs all contained the null value and were therefore considered non-significant. As indicated previously, no significant gains were noted for the LI group. Effect sizes were also determined to be non-significant and ranged from 0 to 0.27. The control group exhibited significant gains ($p \leq .05$) on one outcome measure (i.e., HELP). Effect sizes were medium to large ($d = 0.51 – 1.09$) and had wide CIs that included the null value. The authors also reported between-group differences. Using pretest scores as covariates, the authors found that the SI/LI group had significantly greater ($p < .05$) posttest scores on the BDI than the LI group or the control group, but no significant differences were noted in MLU.

AIT

Two studies (Monville & Nelson, 1994; Tatum et al., 2004) explored the use of AIT. One study (Monville & Nelson, 1994) surveyed parents of children with ASD who received AIT to determine any change they perceived in their child after treatment. Of the survey respondents (42/150, 27%), most parents reported positive changes in language use (79%), social interaction (86%), and sound sensitivity (85%). The data reported were not sufficient to calculate statistical significance or effect sizes. Tatum et al. (2004) conducted two case studies on the use of AIT (i.e., Tomatis Listening Training) in conjunction with speech-language pathology treatment. One participant, an adolescent girl with ASD, received AIT briefly in isolation followed by a combination of AIT with speech-language pathology treatment consisting of a phoneme sequencing program and oral motor therapy. The authors reported that, after more than 15 months of treatment, the girl had mastered a number of speech sounds in isolation and increased her production and use of some functional words. The second participant, a boy diagnosed with auditory processing disorder and attention deficit disorder, also received AIT in combination with a phoneme sequencing program. After 60 sessions, his converted score on the Lindamood Auditory Conceptualization Test (Lindamood & Lindamood, 1979) increased from 62 to 87, indicating above grade-level performance in phonemic awareness skills. Neither statistical significance nor effect sizes were calculable for the reported data.

Quality Indicators

Table 2 shows the methodological quality ratings for each study. Most of the studies (three quarters) provided an adequate description of the study protocol and the included participants. Two investigations reported or supplied sufficient data to calculate statistical significance and effect sizes. One of the studies reported blinding of assessors to the treatment condition and one provided evidence of treatment of fidelity. No study reported random allocation of participants to groups or provided an adequate description of randomization procedures.

Discussion

The primary aim of this review was to determine the evidence on the effects of SIT or sensory-based interventions as provided by, or in collaboration with, SLPs or audiologists on communication outcomes in children. Only four studies were found that met the inclusion criteria of this review. Many investigations were excluded because the treatments were not directly or indirectly provided by the SLP or audiologist or the study did not examine communication outcomes. These were key criteria, given that a primary motivation for conducting this EBSR was to provide ASHA members with guidance on the use of these interventions by SLPs and audiologists to improve communication. Due to the limited number of studies, the small sample sizes, and the variety of populations (e.g., ASD, developmental delay, communication impairment) and interventions investigated (i.e., SIT, vestibular stimulation, and AIT), few conclusions can be drawn about the effects of these treatments.

Of the two studies that provided quantitative data to address the clinical question of this EBSR, one (Kantner et al., 1982) concluded that the addition of vestibular stimulation to a language intervention program did not yield significantly greater gains in language ability than language intervention alone. These results call into question what added value vestibular stimulation may provide in the treatment of communication disorders in children. The other study (Fallon et al., 1994) examined a very small sample (N = 9) of children and compared the outcomes of different interventions (i.e., SIT plus individualized

language treatment, individualized language treatment only, and no treatment) with different populations (i.e., sensory and language impaired, language impaired only, typically developing). This design and these comparisons did not allow for an analysis that could isolate the specific effects of SIT on communication outcomes in similar populations. The two non-experimental studies (Monville & Nelson, 1994; Tatum et al., 2004) that investigated AIT provided insufficient data, insight, or clarification to address the questions and controversy surrounding this intervention.

Recently, the AAP issued a policy statement regarding sensory integration therapies (2012). The policy noted the lack of a commonly recognized framework for determining a sensory processing disorder and recommended against using *sensory processing disorder* as a separate diagnosis. Instead, it advised physicians to consider, and evaluate for, other disorders that may present with sensory symptoms, such as ASD or anxiety disorder. It also urged pediatricians to inform families about the limited data on the effectiveness of sensory-based treatments for children with developmental or behavioral disorders. These recommendations highlight the necessity for additional research on this topic and the need for caution when considering implementing treatments designed to target sensory processing deficits.

Limitations of Current Review and Future Directions

The results of this EBSR should be interpreted in light of several considerations and limitations. First, only articles published in English in peer-reviewed journals were included in this EBSR. Therefore, other relevant investigations (either unpublished or published, in another language) may have been missed or not considered. Additionally, as noted previously, few studies met the eligibility criteria for this EBSR and several of the included studies had few participants and/or considerable methodological limitations. These factors significantly restrict the clinical utility of the available findings. Future research would benefit from larger studies with well-defined participants and increased methodological rigor (e.g., random assignment, blinded assessors). These studies should be designed with adequate controls to determine what added benefit SIT may provide in ameliorating communication disorders in children.

Conclusion

The current findings are minimal and provide little guidance to clinicians. Given these results and noted concerns, SLPs and audiologists should be cautious about providing sensory-based interventions, such as SIT, in lieu of more direct or empirically-supported treatments targeting communication deficits (e.g., skill-based treatments). Yet, children with sensory issues may seek out certain sensory experiences. As part of best practice, clinicians should always consider individual preferences when providing intervention. In these cases, incorporating sensory-based activities (e.g., tactile stimulation, vestibular stimulation) with skill-based treatments may be motivating or make treatment more enjoyable for the child. However, further research is needed to better understand the nature of sensory processing disorder and the associated treatments as well as any role of the SLP or audiologist. At this time, the current best research-evidence, clinical expertise, and the client's preferences, as noted above, should be considered by clinicians when developing treatment protocols for children with concomitant communication and sensory deficits.

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Table 1. Study characteristics and results

Citation	N	Reported age range (and/or mean)	Gender	Reported medical and/or SLP diagnosis	Intervention	Treatment schedule	Outcome measures	Findings	Effect size [95% CI]
Fallon et al. (1994)	9	18–42 mos	5 M 4 F	Group 1: sensory and language impairment Group 2: language impairment with no sensory impairment Group 3: typically developing language-matched controls Additional diagnoses included: ASD, developmental delay, mental disabilities, learning disabled, and communication disordered	Group 1: individualized sensory integration and SLP treatment Group 2: individualized SLP treatment Group 3: no treatment	Group 1: 30-min sessions, 3x/wk for 14 wks Group 2: 20-min sessions, 3x/wk for 14 wks	**Group 1 (Change from pretest to posttest)**		
							HELP language subtest	*ns*	0.58 [–1.16, 2.08]
							BDI communication subtest	$p \leq .01$	1.59 [–0.48, 3.02]
							MLU	*ns*	1.24 [–0.7, 2.69]
							Group 2 (Change from pretest to posttest)		
							HELP language subtest	*ns*	0.17 [–1.46, 1.74]
							BDI communication subtest	*ns*	0.27 [–1.39, 1.82]
							MLU	*ns*	0 [–1.6, 1.6]
							Group 3 (Change from pretest to posttest)		
							HELP language subtest	$p \leq .05$	0.51 [–1.21, 2.03]
							BDI communication subtest	*ns*	0.69 [–1.08, 2.18]
							MLU	*ns*	1.09 [–0.8, 2.55]

Kantner et al. (1982)	30	5–14 yrs (9.2 yrs)	17 M 13 F	Intellectual disability	Group 1: vestibular stimulation and individualized SLP treatment Group 2: individualized SLP treatment Group 3: general speech and language stimulation	Group 1: vestibular stimulation (2x/wk for 6 wks) and SLP treatment (4x/wk for 6 wks) Groups 2 and 3: SLP treatment/general stimulation (4x/wk for 6 wks)	**Group 1 versus Group 2**		
							PICAC Overall	*ns*	–0.12 [–0.99, 0.76]
							PICAC general communication subscale	*ns*	–0.15 [–1.02, 0.73]
							PICAC verbal language subscale	*ns*	–0.07 [–0.94, 0.81]
							PICAC visual language subscale	*ns*	–0.38 [–1.24, 0.52]
							PICAC gestural language subscale	*ns*	–0.37 [–1.24, 0.53]
							PICAC auditory language subscale	*ns*	0 [–0.87, 0.88]
							PICAC graphic language subscale	*ns*	0.16 [–0.73, 1.03]
Monville & Nelson (1994)	41	4:4–25:8 yrs (12 yrs)	29 M 12 F	ASD	AIT	NR	Retrospective survey assessing parent perception of child change after AIT	NR	NR
Tatum et al. (2004)	2	Case 1: 14 yrs	F	ASD	Phase 1: AIT (Tomatis)	Phase 1: 30 hrs Phase 2: 60-min	Word and sound production	NR	NR

			Phase 2: AIT + LiPS Phase 3: AIT + Beckman Oral Motor Therapy and SLP treatment	sessions, 3x/wk for 120 hrs Phase 3: 1-hr sessions for 5 mos			
Case 2: 9 yrs	M	ADHD & APD	AIT (Tomatis) + LiPS	60, 1-hr sessions	Lindamood Auditory Conceptualization Test	NR	NR

Note: PICAC= Porch Index of Communicative Ability in Children; HELP = Hawaii Early Learning Profile; BDI = Batelle Developmental Inventory; LiPS = Lindamood Phoneme Sequencing Training; ADHD = Attention deficit hyperactivity disorder; APD = Auditory processing disorder; NR = Not reported or calculable

Table 2. Methodological quality of included studies

Citation	Study design	Critical Appraisal Points							
		Adequate protocol description	Participant comparability/ adequate description	Assessor blinded	Adequate random sampling/ allocation	Treatment fidelity	Significance reported or calculable	Precision reported or calculable ES/CI	Intention to treat
Fallon et al. (1994)	Controlled trial	-	+	-	-	+	+	+	N/A
Kantner et al. (1982)	Controlled trial	+	+	+	-	-	+	+	N/A
Monville & Nelson (1994)	Retrospective survey	+	+	-	-	-	-	-	N/A
Tatum et al. (2004)	Case study	+	+/-	-	-	-	-	-	N/A

Note. CI = confidence interval; ES = effect size; N/A = not applicable; + = criterion fulfilled; − = criterion not fulfilled +/- = Criterion fulfilled for one participant but not the other.

Appendix A. Search methodology

Electronic Databases searched (27 total):

CINAHL (EBSCO)

Cochrane Library (Wiley)

ComDisDome (CSA)

Communication & Mass Media Complete (EBSCO)

Centre for Reviews and Dissemination Databases (www.crd.york.ac.uk/crdweb/)

Early Hearing Detection and Intervention (EHDI) (www2.cdc.gov/ncbddd/ehdi/pubs/default.asp)

Education Research Complete (EBSCO)

Educational Resources Information Center (ERIC)

GoogleScholar

Health Source: Nursing/Academic Edition (EBSCO)

HighWire Press

Linguistics Language Behaviour Abstracts (CSA)

Latin American and Caribbean Center on Health Sciences Information (LILACS) (www.bireme.br/php/index.php?lang=en)

National Rehabilitation Information Center - REHABDATA (http://www.naric.com/research)

Otseeker (www.otseeker.com/)

PEDro (www.pedro.org.au/)

PsycBITE (www.psycbite.com/)

Psychology and Behavioral Sciences Collection (EBSCO)

PsycINFO (EBSCO)

PubMed (NLM)

Science Citation Index Expanded (ISI)

ScienceDirect (Elsevier)

Social Sciences Citation Index (ISI)

Social Services Abstracts (CSA)

SpeechBITE (www.speechbite.com/)

Teacher Reference Center (EBSCO)

TripDatabase (www.tripdatabase.com/)

General Search Strategy:

SI treatment + (SLP/AuD) + communication outcomes + preschool/school-age

Also pull any systematic reviews or meta-analyses on SI treatment

Search Criteria:

Date of publication 1970 to present (including articles in press)

English language only

Published in peer-reviewed publication only

Must be a study with original data that addresses the question

Inclusion criteria:

Must include preschool or school-aged children ages 3–18

Must include treatment performed directly or indirectly by an SLP or audiologist

(Exclude oral motor treatment)

Search log:

Date	Database	Search terms	Yield
10/3/11 10/4/11	PubMed	(((“Sensory integration” OR “sensory integrative” OR “auditory integration”) AND (therapy OR treatment OR intervention OR training OR theory OR regulation OR modulation)) OR "sensory motor therapy" OR "sensory motor training") **Limits Activated:** English, Publication Date from 1970 to 2011	425
10/4/11	PubMed	("Somatosensory Disorders/rehabilitation"[Mesh] OR "Somatosensory Disorders/therapy"[Mesh] OR "Occupational Therapy/methods"[Mesh] OR "Feedback, Sensory"[Mesh] OR "Acoustic Stimulation/methods"[Mesh]) AND ("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Mental Retardation"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh]) AND ("Rehabilitation of Speech and Language Disorders"[Mesh] OR "Speech-Language Pathology"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/therapy"[Mesh] OR “speech language pathologist” OR “speech therapist” OR audiolog* OR "Audiology"[Mesh]) **Limits Activated:** English, Preschool Child: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years, Publication Date from 1970 to 2011	53
10/11/11	PubMed	("Occupational Therapy/methods"[Mesh] OR "Feedback, Sensory"[Mesh] OR "Acoustic	435

10/17/11 10/18/11		Stimulation/methods"[Mesh]) AND ("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Mental Retardation"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh]) **Limits Activated:** English, Preschool Child: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years, Publication Date from 1970 to 2012	
10/24/11 10/25/11 10/28/11	PubMed	("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Mental Retardation"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh]) AND ((sensory OR sensorimotor OR “sensory motor”) AND (integrat* OR stimulation OR defensive* OR seeking OR modulation OR regulation OR discrimination OR input OR learning OR skills OR therapy OR theory OR intervention OR treatment OR training)) AND (speech OR communicat* OR language OR lingual OR hearing OR verbal OR talk* OR audiolog* OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/therapy"[Mesh]) **Limits Activated:** English, Preschool Child: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years, Publication	780

		Date from 1970 to 2012	
11/7/11	PubMed	("Somatosensory Disorders/rehabilitation"[Mesh] OR "Somatosensory Disorders/therapy"[Mesh]) **Limits Activated:** English, Preschool Child: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years, Publication Date from 1970 to 2012	145
11/10/11 11/17/11 11/23/11	PubMed	("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Mental Retardation"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh]) AND (“emotional regulation” OR “clumsy child” OR “clumsy children” OR “developmental coordination” OR massage OR “natural environment” OR “therapeutic listening” OR Wilbarger OR “sensation seeking” OR “sensory processing” OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitiv* OR underresponsiv* OR dyspraxia OR handwriting OR “adaptive behavior” OR “behavior modification“ OR “postural disorder” OR touch OR pressure OR weighted) OR ((sensory OR sensorimotor OR “sensory motor”) AND (integrat* OR stimulation OR defensive* OR seeking OR modulation OR regulation OR discrimination OR input OR learning OR skills OR therapy OR theory OR intervention OR treatment OR training)) OR ((auditory OR perceptual OR behavioral OR behavioural OR motor OR tactile OR vestibular OR proprioceptive OR visual OR spatial) AND (integrat* OR learning OR skills OR sensory OR discrimination OR input OR regulation OR therapy OR theory OR intervention OR treatment OR training)) AND (“Sensation Disorders/rehabilitation”[Mesh] OR “Sensation Disorders/therapy”[Mesh] OR "Auditory	2485

		Perceptual Disorders/rehabilitation"[Mesh] OR "Auditory Perceptual Disorders/therapy"[Mesh]) **Limits Activated:** English, Preschool Child: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years, Publication Date from 1970 to 2012	
11/23/11	PubMed	("vestibular stimulation" OR "sound therapy" OR "sound therapies" OR "sound training" OR samonas OR tomatis or "listening intervention" OR "Therapeutic Touch"[Mesh]) AND (“Sensation Disorders”[Mesh] OR "Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Mental Retardation"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh] OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Communication Disorders"[Mesh] OR "Auditory Perceptual Disorders"[Mesh]) **Limits Activated:** English, Publication Date from 1970 to 2011	167
4/6/12	PubMed	("Hydrotherapy"[Mesh] OR "Animal Assisted Therapy"[Mesh] OR (diet AND sensory) OR snoezelen OR "sensory environment") AND ("Sensation Disorders"[Mesh] OR "Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Intellectual Disability"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular	43

		Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh] OR "Auditory Perceptual Disorders"[Mesh]) AND (speech OR language OR communicat* OR social OR verbal OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Communication Disorders"[Mesh]) **Limits Activated:** English, Publication Date from 1970 to 2012	
11/29/11	CINAHL	(MH "Sensory Motor Integration") AND ((MH "Rehabilitation, Speech and Language+") OR (MH "Speech-Language Pathology"))	27
12/9/11 12/13/11 12/14/11	CINAHL	((("Sensory integration" OR "sensory integrative" OR "auditory integration" OR (MH "Sensory Motor Integration") OR tomatis OR samonas OR berard) AND (therapy OR treatment OR intervention OR training OR theory OR regulation OR modulation OR (MH "Rehabilitation+"))) OR "sensory motor therapy" OR "sensory motor training" OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention") **Limits:** 1970–2011, English, Peer-Reviewed, Academic Journals	683
12/16/11	CINAHL	((MH "Sensation Disorders+/TH/RH") OR (MH "Auditory Perceptual Disorders/TH/RH") OR (MH "Sensory Stimulation+/MT")) AND ((MH "Mental Disorders Diagnosed in Childhood+") OR (MH "Fetal Alcohol Syndrome") OR (MH "Brain Injuries+") OR (MH "Brain Damage, Chronic+") OR (MH "Cerebrovascular Disorders+") OR (MH "Epilepsy+") OR (MH "Spina Bifida") OR "cerebral palsy" OR autis* OR ADHD OR aphasia OR dyspraxia OR dyslexia OR handwriting) **Limits:** 1970–2011; English Language; Peer reviewed; Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	112
12/21/11 12/28/11	CINAHL	(MH "Hearing Disorders+") AND ((sensory OR sensorimotor OR "sensory motor" OR sensation OR auditory OR sound OR perceptual OR tactile OR vestibular OR proprioceptive OR spatial OR touch OR	487

		massage OR music OR berard OR tomatis OR samonas OR "therapeutic listening") AND (integrat* OR defensive* OR seeking OR modulation OR processing OR therap* OR treatment* OR intervention OR training)) **Limits:** 1970–2011; English Language; Peer reviewed; Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	
12/28/11 12/29/11	CINAHL	(speech OR language OR verbal OR social OR communicat* OR hearing) AND (sensory OR sensorimotor OR "sensory motor" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR dyspraxia OR "postural disorder" OR "clumsy child" OR "clumsy children" OR "developmental coordination" OR tactile OR vestibular OR proprioceptive OR touch OR pressure OR weighted OR wilbarger OR brush OR massage) AND (therapy OR treatment OR intervention OR rehabilitation OR integrat* OR stimulation OR defensive* OR seeking OR modulation OR regulation OR discrimination OR input OR learning OR theory OR training) AND ((MH "Mental Disorders Diagnosed in Childhood+") OR (MH "Hearing Disorders+") OR (MH "Fetal Alcohol Syndrome") OR (MH "Brain Injuries+") OR (MH "Brain Damage, Chronic+") OR (MH "Cerebrovascular Disorders+") OR (MH "Epilepsy+") OR (MH "Spina Bifida") OR (MH "Sensation Disorders")) **Limits:** 1970–2012; English Language; Peer reviewed; Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	415
1/5/12	CINAHL	(MH "Occupational Therapy+/MT") AND ((MH "Mental Disorders Diagnosed in Childhood+") OR (MH "Hearing Disorders+") OR (MH "Fetal Alcohol Syndrome") OR (MH "Brain Injuries+") OR (MH "Brain Damage, Chronic+") OR (MH "Cerebrovascular Disorders+") OR (MH "Epilepsy+") OR (MH "Spina Bifida")) **Limits:** 1970–2011; English Language; Peer reviewed; Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	60

1/5/12	PsycINFO	(("Sensory integration" OR "sensory integrative" OR "auditory integration" OR MM "Sensory Integration" OR berard OR tomatis OR samonas) AND (therapy OR treatment OR intervention OR training OR theory OR regulation OR modulation OR MM "Speech Therapy" OR MM "Treatment" OR MM "Language Therapy" OR MM "Rehabilitation" OR MM "Speech Language Pathology")) OR "sensory motor therapy" OR "sensory motor training" OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" **Limits:** 1970–2011, English, Peer-reviewed, Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	212
1/12/12	PsycINFO	(DE "Sensory System Disorders" OR DE "Sense Organ Disorders" OR DE "Somatosensory Disorders" OR DE "Auditory Stimulation" OR DE "Auditory Perception" OR DE "Sensory Integration") AND (DE "Treatment" OR DE "Language Therapy" OR DE "Speech Therapy" OR DE "Occupational Therapy") **Limits:** 1970–2012, English, Peer-reviewed, Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	76
1/19/12 1/20/12 1/23/12 1/27/12 2/6/12 2/8/12 2/10/12 2/13/12	PsycINFO	(speech OR language OR verbal OR social OR communicat* OR hearing) **AND** (sensory OR sensorimotor OR "sensory motor" OR berard OR tomatis OR samonas OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR dyspraxia OR "postural disorder" OR "clumsy child" OR "clumsy children" OR "developmental coordination" OR "emotional regulation" OR "therapeutic listening" OR auditory OR perceptual OR tactile OR vestibular OR proprioceptive OR touch OR pressure OR weighted OR wilbarger OR brush OR music OR massage) **AND** (therapy OR treatment OR intervention OR rehabilitation OR integrat* OR stimulation OR defensive* OR seeking OR modulation OR regulation OR discrimination OR input OR learning OR theory OR training) **AND** (DE "Sensory System Disorders" OR DE "Sense Organ Disorders" OR DE "Somatosensory Disorders" OR DE "Attention Deficit Disorder" OR DE "Attention Deficit	2093

		Disorder with Hyperactivity" OR DE "Pervasive Developmental Disorders" OR DE "Aspergers Syndrome" OR DE "Autism" OR DE "Rett Syndrome" OR DE "Learning Disorders" OR DE "Learning Disabilities" OR DE "Reading Disabilities" OR DE "Developmental Disabilities" OR DE "Specific Language Impairment" OR DE "Behavior Disorders" OR DE "Juvenile Delinquency" OR DE "Communication Disorders" OR DE "Hearing Disorders" OR DE "Language Disorders" OR DE "Speech Disorders" OR DE "Mental Retardation" OR DE "Anencephaly" OR DE "Borderline Mental Retardation" OR DE "Crying Cat Syndrome" OR DE "Down's Syndrome" OR DE "Home Reared Mentally Retarded" OR DE "Institutionalized Mentally Retarded" OR DE "Mild Mental Retardation" OR DE "Moderate Mental Retardation" OR DE "Profound Mental Retardation" OR DE "Psychosocial Mental Retardation" OR DE "Severe Mental Retardation" OR DE "Tay Sachs Disease" OR DE "Movement Disorders" OR DE "Alien Limb Syndrome" OR DE "Apraxia" OR DE "Ataxia" OR DE "Athetosis" OR DE "Catalepsy" OR DE "Cataplexy" OR DE "Chorea" OR DE "Dyskinesia" OR DE "Dyspraxia" OR DE "Myasthenia Gravis" OR DE "Paralysis" OR DE "Spasms" OR DE "Tics" OR DE "Torticollis" OR DE "Tremor" OR DE "Fetal Alcohol Syndrome" OR DE "Brain Disorders" OR DE "Acute Alcoholic Intoxication" OR DE "Anencephaly" OR DE "Aphasia" OR DE "Athetosis" OR DE "Balint's Syndrome" OR DE "Brain Damage" OR DE "Brain Neoplasms" OR DE "Cerebral Palsy" OR DE "Cerebrovascular Accidents" OR DE "Chronic Alcoholic Intoxication" OR DE "Diaschisis" OR DE "Dysexecutive Syndrome" OR DE "Encephalitis" OR DE "Encephalopathies" OR DE "Epilepsy" OR DE "Epileptic Seizures" OR DE "General Paresis" OR DE "Hydrocephalus" OR DE "Intracranial Abscesses" OR DE "Kluver Bucy Syndrome" OR DE "Leukoencephalopathy" OR DE "Microcephaly" OR DE "Organic Brain Syndromes" OR DE "Parkinson's Disease" OR DE "Tay Sachs Disease" OR DE "Cerebrovascular Disorders" OR DE "Cerebral Arteriosclerosis" OR DE "Cerebral Hemorrhage" OR DE "Cerebral Ischemia" OR DE "Cerebral Small Vessel Disease" OR DE "Cerebrovascular Accidents" OR DE	

		"Subarachnoid Hemorrhage" OR DE "Spina Bifida") **Limits:** 1970–2011; English Language; Peer reviewed; Age Groups: Child, Preschool: 2–5 years, Child: 6–12 years, Adolescent: 13–18 years	
2/22/12 3/7/12	Health Source: Nursing/Academic Edition, Psychology and Behavioral Sciences Collection, Teacher Reference Center, Communication & Mass Media Complete, Education Research Complete	((("Sensory integration" OR "sensory integrative" OR "auditory integration") AND (therapy OR treatment OR intervention OR training OR theory OR regulation OR modulation)) OR "sensory motor therapy" OR "sensory motor training" OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" OR "auditory training" OR "therapeutic listening") **Limits:** 1970–2012, English, Scholarly Peer-Reviewed Journals	355
3/7/12	Health Source: Nursing/Academic Edition; Psychology and Behavioral Sciences Collection; Teacher Reference Center; Communication & Mass Media Complete; Education Research Complete	(vestibular AND (stimulation OR training OR therapy OR rehabilitation OR treatment) AND (speech OR language OR communicat* OR hearing)) OR ((berard OR tomatis OR samonas) AND (auditory OR hearing OR audiolog* OR speech)) **Limits:** 1970–2012, English, Scholarly Peer-Reviewed Journals	197
3/9/12 3/13/12 3/16/12	Health Source: Nursing/Academic Edition, Psychology and Behavioral	(speech OR language OR communicat* OR hearing) AND (sensory OR sensorimotor OR "sensory motor" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR tactile OR touch OR weighted OR wilbarger OR brush OR massage OR	1238

3/20/12	Sciences Collection, Teacher Reference Center, Communication & Mass Media Complete, Education Research Complete	"sensation seeking") AND (therapy OR treatment OR intervention OR rehabilitation OR training) **Limits:** 1970–2012, English, Scholarly Peer-Reviewed Journals	
3/20/12	CINAHL, PsycINFO, Health Source: Nursing/Academic Edition, Psychology and Behavioral Sciences Collection, Teacher Reference Center, Communication & Mass Media Complete, Education Research Complete	((("alternative therapies" AND (sensory OR sensation OR touch OR massage OR pressure OR propioceptive OR spatial)) OR (hydrotherapy OR hippotherapy OR equine-assisted OR (diet AND sensory) OR snoezelen)) AND (speech OR language OR communicat* OR hearing OR social) AND (child* OR student* OR adolescent* OR preschool* OR grader) **Limits:** 1970–2012, English, Peer-Reviewed	109
3/22/12	ERIC (ProQuest)	All ((speech OR language OR communicat* OR hearing OR social) AND (sensory OR sensorimotor OR "sensory motor" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR tactile OR touch OR wilbarger OR massage OR "sensation seeking") AND (therapy OR treatment OR intervention OR rehabilitation OR training)) Date: 1970–2012; Peer-Reviewed; English; Early childhood education, Elementary education, Elementary secondary education, Grade 1, Grade 10, Grade 11, Grade 12, Grade 2, Grade 3, Grade 4, Grade 5, Grade 6,	33

		Grade 7, Grade 8, Grade 9, High schools, Intermediate grades, Junior high schools, Kindergarten, Middle schools, Preschool education, Primary education, Secondary education	
3/22/12	ComDisDome, ERIC, LLBA, Social Services Abstracts	• All ((((("Sensory integration" OR "sensory integrative" OR "auditory integration") AND (therapy OR treatment OR intervention OR training OR theory OR regulation OR modulation OR stimulation)) OR "sensory motor therapy" OR "sensory motor training" OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" OR "auditory training" OR "therapeutic listening")) • Date: 1970–2012, Peer-Reviewed, English, Scholarly Journals, Reports, Other sources	370
3/23/12	ERIC	SU.exact("SENSORY TRAINING")	31
3/23/12	ERIC	EXACT("Perceptual Motor Learning" OR "Sensory Integration" OR "Sensory Experience") Date: 1970–2012; Peer-Reviewed; English; Early childhood education, Elementary education, Elementary secondary education, Grade 1, Grade 10, Grade 11, Grade 12, Grade 2, Grade 3, Grade 4, Grade 5, Grade 6, Grade 7, Grade 8, Grade 9, High schools, Intermediate grades, Junior high schools, Kindergarten, Middle schools, Preschool education, Primary education, Secondary education	73
3/26/12	ComDisDome	all((sensory OR sensorimotor OR "sensory motor" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR touch OR wilbarger OR massage OR "sensation seeking") AND (therapy OR treatment OR intervention OR rehabilitation OR training) AND (child* OR student* OR adolescent* OR preschool* OR grader* OR kindergarten*)) • **Limits:** 1970–2012, Other Sources, Reports, Scholarly Journals, English, Peer-reviewed	497
3/27/12	LLBA	all((sensory OR sensorimotor OR "sensory motor" OR	200

		hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR touch OR wilbarger OR massage OR "sensation seeking") AND (therapy OR treatment OR intervention OR rehabilitation OR training) AND (child* OR student* OR adolescent* OR preschool* OR grader* OR kindergarten*)) **Limits:** 1970–2012, Scholarly Journals, English, Peer-reviewed	
3/27/12	Social Science Abstracts	all((sensory OR sensorimotor OR "sensory motor" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitive* OR underresponsiv* OR touch OR wilbarger OR massage OR "sensation seeking") AND (therapy OR treatment OR intervention OR rehabilitation OR training) AND (child* OR student* OR adolescent* OR preschool* OR grader* OR kindergarten*) AND (speech OR language OR hearing OR communicat* OR social)) **Limits:** Journal Article, Review, English, Peer-reviewed	86
3/28/12	ComDisDome, ERIC, LLBA, Social Science Abstracts	all((vestibular AND (stimulation OR training OR therapy OR rehabilitation OR treatment) AND (speech OR language OR communicat*)) OR ((berard OR tomatis OR samonas) AND (auditory OR hearing OR audiolog* OR speech))) **Limits:** 1970–2012, Other Sources, Reports, Scholarly Journals, English, Peer-reviewed	224
3/29/12 3/30/12	ComDisDome, ERIC, LLBA, Social Science Abstracts	all(child OR children OR student* OR adolescent* OR preschool*) AND all(speech OR communicat* OR language OR social OR occupational) AND all(sensory OR sensorimotor OR "sensory motor" OR perceptual OR tactile OR vestibular OR proprioceptive OR spatial OR massage OR brush* OR Wilbarger OR snoezelen OR touch OR weighted OR "multisensory environment" OR "sensory environment" OR hippotherapy OR hydrotherapy OR animal-assisted OR equine-assisted) AND all(integrat* OR stimulation OR modulation OR regulation OR discrimination OR input OR therapy OR intervention OR treatment OR training OR activity OR theory) AND all(ADHD OR "attention deficit disorder" OR "attention deficit hyperactivity disorder" OR autism OR autistic OR asperger OR "sensory deprivation" OR	835

		"fragile x syndrome" OR "fetal alcohol syndrome" OR "learning disability" OR "learning disabilities" OR "learning disorder" OR "developmental disability" OR "developmental disabilities" OR "developmental disorder" OR "developmental delay" OR "communicative dysfunction" OR "communication disability" OR "speech disorder" OR "language disorder" OR "communication disorder" OR dyslexia OR agraphia OR anomia OR aphasia OR dysphasia OR dysgraphia OR alexia OR aprosodia OR "cerebrovascular disorder" OR "brain injury" OR "cerebral palsy" OR stroke OR "mental retardation" OR "intellectual disability" OR "intellectual disabilities" OR "intellectual deficiencies" OR "regulatory disorder" OR epilepsy OR "spina bifida" OR clumsy OR "coordination disorder" OR "motor skills disorder" OR "motor disorder" OR "perception disorder" OR dyspraxia OR apraxia OR "motor deficit" OR "sensory integrative dysfunction" OR "sensory modulation disorder" OR "sensory modulation dysfunction" OR "sensory processing disorder" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitiv* OR underresponsiv* OR "sensory defensiveness" OR "sensation seeking" OR "postural disorder" OR "emotional regulation" OR handwriting OR mutism OR "sensation disorder" OR "neuromuscular disorder" OR "sensory disorder" OR "sensory dysfunction" OR "sensory impairment" OR "childhood disintegrative disorder" OR "movement disorder") **Limits:** 1970–2012, Scholarly Journals, English, Peer-reviewed	
4/5/12	Cochrane	(speech OR language OR communicat*) AND ("sensory integration" OR "sensory modulation" OR "sensory regulation" OR "sensory input" OR "sensory integrative" OR sensorimotor OR "sensory motor") AND (therapy OR treatment OR intervention OR rehabilitation OR stimulation OR training) AND (child* OR student* OR adolescent* OR preschool* OR grader* OR kindergarten*) AND ("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR	121

		"Communication Disorders"[Mesh] OR "Intellectual Disability"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh] OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Speech-Language Pathology"[Mesh] OR "Audiology"[Mesh]) **Limits:** 1970 to 2012	
4/5/12	Cochrane	("auditory integration" AND (stimulation OR training OR therapy OR rehabilitation OR treatment)) OR ("auditory training" AND (music OR modif* OR unmodified)) OR ((berard OR tomatis OR samonas OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" OR “therapeutic listening”) AND (auditory OR hearing OR audiolog* OR speech))	45
4/5/12	Cochrane	"Somatosensory Disorders/rehabilitation"[Mesh] OR "Somatosensory Disorders/therapy"[Mesh]	40
4/5/12	Cochrane	("Occupational Therapy"[Mesh] OR "Feedback, Sensory"[Mesh]) AND ("Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Intellectual Disability"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh] OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Speech-Language Pathology"[Mesh] OR "Audiology"[Mesh])	144
4/5/12	Cochrane	("Acoustic Stimulation"[Mesh] OR "Auditory Perceptual Disorders"[Mesh]) AND ("Attention Deficit and	99

		Disruptive Behavior Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Learning Disorders"[Mesh] OR "Developmental Disabilities"[Mesh] OR "Communication Disorders"[Mesh] OR "Intellectual Disability"[Mesh] OR "Motor Skills Disorders"[Mesh] OR "Stereotypic Movement Disorder"[Mesh] OR "Hearing Loss"[Mesh] OR "Fetal Alcohol Syndrome"[Mesh] OR "Brain Injuries"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Cerebrovascular Disorders"[Mesh] OR "Epilepsy"[Mesh] OR "Spinal Dysraphism"[Mesh] OR "Rehabilitation of Speech and Language Disorders"[Mesh] OR "Speech-Language Pathology"[Mesh] OR "Audiology"[Mesh])	
4/20/12	Web of Science (SCI-EXPANDED, SSCI)	Topic=(((berard OR tomatis OR samonas OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" OR "therapeutic listening") AND (auditory OR hearing OR audiolog* OR speech)) OR ("auditory integration" AND (stimulation OR training OR therapy OR rehabilitation OR treatment)) OR ("auditory training" AND (music OR modif* OR unmodified))) Lemmatization=On, English language, All Years	115
4/20/12 4/23/12 4/27/12 5/6/12	Web of Science (SCI-EXPANDED, SSCI)	Topic=((((“Sensory integration” OR “sensory integrative") AND (therapy OR treatment OR intervention OR training)) OR "sensory motor therapy" OR "sensory motor training")) **OR** Topic=((child OR children OR student* OR adolescent* OR preschool* OR kid*) AND (speech OR communicat* OR language OR social OR occupational) AND (sensory OR sensorimotor OR "sensory motor" OR perceptual OR tactile OR vestibular OR proprioceptive OR spatial OR massage OR brush* OR Wilbarger OR snoezelen OR touch OR weighted OR "multisensory environment" OR "sensory environment" OR hippotherapy OR equine-assisted)) AND Topic=((integrat* OR stimulation OR modulation OR regulation OR discrimination OR input OR therapy OR intervention OR treatment OR training	1396

		OR activity OR theory)) AND Topic=((ADHD OR "attention deficit disorder" OR "attention deficit hyperactivity disorder" OR autism OR autistic OR asperger OR "sensory deprivation" OR "fragile x syndrome" OR "fetal alcohol syndrome" OR "learning disability" OR "learning disabilities" OR "learning disorder" OR "developmental disability" OR "developmental disabilities" OR "developmental disorder" OR "developmental delay" OR "communicative dysfunction" OR "communication disability" OR "speech disorder" OR "language disorder" OR "communication disorder" OR dyslexia OR agraphia OR anomia OR aphasia OR dysphasia OR dysgraphia OR alexia OR aprosodia OR "cerebrovascular disorder" OR "brain injury" OR "cerebral palsy" OR stroke OR "mental retardation" OR "intellectual disability" OR "intellectual disabilities" OR "intellectual deficiencies" OR "regulatory disorder" OR epilepsy OR "spina bifida" OR clumsy OR "coordination disorder" OR "motor skills disorder" OR "motor disorder" OR "perception disorder" OR dyspraxia OR apraxia OR "motor deficit" OR "sensory integrative dysfunction" OR "sensory modulation disorder" OR "sensory modulation dysfunction" OR "sensory processing disorder" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitiv* OR underresponsiv* OR "sensory defensiveness" OR "sensation seeking" OR "postural disorder" OR "emotional regulation" OR handwriting OR mutism OR "sensation disorder" OR "neuromuscular disorder" OR "sensory disorder" OR "sensory dysfunction" OR "sensory impairment" OR "childhood disintegrative disorder" OR "movement disorder")) **Limits:** Language=(English), Document Types=(Article OR Abstract of Published Item OR Review), Lemmatization=On, All Years	
5/9/12 5/11/12	Science Direct	((berard OR tomatis OR samonas OR "sound therapy" OR "sound therapies" OR "sound training" OR "listening intervention" OR "therapeutic listening") AND (auditory OR hearing OR audiolog* OR speech)) **OR** ("auditory integration" AND (stimulation OR training OR therapy OR rehabilitation OR treatment)) **OR** ("auditory training" AND (music OR modif* OR unmodified))	613

		Limits: 1970–2012, Favorite journals* *includes all journals from *Neuroscience*; *Clinical Neurology*; *Complementary and Alternative Medicine*; *Perinatology, Pediatrics, and Child Health, Psychiatry and Mental Health*; *Nursing; Nursing and Health Professions*; *Nutrition*; *Occupational Therapy*; *Optometry*; *Physical Therapy and Rehabilitation*; *Primary Care*; *Language and Linguistics*; *Psychology*; *Education*; *Health*; *Linguistics and Language*	
5/11/12 5/14/12	Science Direct	("vestibular rehabilitation" OR "vestibular stimulation" OR "vestibular treatment" OR "vestibular therapy" OR "vestibular movement") AND (speech OR language OR communicat* OR social OR occupational) AND (child OR children OR student* OR adolescent* OR preschool*) **Limits:** 1970–2012, Favorite journals*	370
5/14/12 5/16/12 5/17/12	Science Direct	(massage OR Wilbarger OR snoezelen OR "weighted vest" OR "multisensory environment" OR "sensory environment") AND (integrat* OR stimulation OR therapy OR intervention OR treatment OR training OR activity) AND (ADHD OR "attention deficit disorder" OR "attention deficit hyperactivity disorder" OR autism OR autistic OR asperger OR "sensory deprivation" OR "fragile x syndrome" OR "fetal alcohol syndrome" OR "learning disability" OR "learning disabilities" OR "learning disorder" OR "developmental disability" OR "developmental disabilities" OR "developmental disorder" OR "developmental delay" OR "communicative dysfunction" OR "communication disability" OR "speech disorder" OR "language disorder" OR "communication disorder" OR dyslexia OR agraphia OR anomia OR aphasia OR dysphasia OR dysgraphia OR alexia OR aprosodia OR "cerebrovascular disorder" OR "brain injury" OR "cerebral palsy" OR stroke OR "mental retardation" OR "intellectual disability" OR "intellectual disabilities" OR "intellectual deficiencies" OR "regulatory disorder" OR epilepsy OR "spina bifida" OR clumsy OR "coordination disorder" OR "motor skills disorder" OR "motor disorder" OR "perception disorder"	1141

		OR dyspraxia OR apraxia OR "motor deficit" OR "sensory integrative dysfunction" OR "sensory modulation disorder" OR "sensory modulation dysfunction" OR "sensory processing disorder" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitiv* OR underresponsiv* OR "sensory defensiveness" OR "sensation seeking" OR "postural disorder" OR "emotional regulation" OR handwriting OR mutism OR "sensation disorder" OR "neuromuscular disorder" OR "sensory disorder" OR "sensory dysfunction" OR "sensory impairment" OR "childhood disintegrative disorder" OR "movement disorder") AND (speech OR communicat* OR social OR occupational) AND (child OR children OR student* OR adolescent* OR preschool*) **Limits:** 1970–2012, Favorite journals*	
5/21/12 5/23/12 6/11/12 6/14/12	Science Direct	(speech OR language OR social OR communicat* OR occupational) AND ("sensory integration" OR "sensory integrative" OR "sensory therapy" OR "sensory treatment" OR "sensory intervention" OR "sensory training" OR "sensory motor therapy" OR "sensory motor treatment" OR "sensory motor intervention" OR "sensory motor training" OR "sensorimotor therapy" OR "sensorimotor treatment" OR "sensorimotor intervention" OR "sensorimotor training" OR "sensory stimulation" OR "tactile stimulation" OR "proprioceptive training" OR "proprioceptive stimulation" OR "perceptual motor training" OR "perceptual training" OR "spatial training" OR "sensory activity") AND (child OR children OR student* OR adolescent* OR preschool*) AND (ADHD OR "attention deficit disorder" OR "attention deficit hyperactivity disorder" OR autism OR autistic OR asperger OR "sensory deprivation" OR "fragile x syndrome" OR "fetal alcohol syndrome" OR "learning disability" OR "learning disabilities" OR "learning disorder" OR "developmental disability" OR "developmental disabilities" OR "developmental disorder" OR "developmental delay" OR "communicative dysfunction" OR "communication disability" OR "speech disorder" OR "language disorder" OR "communication disorder" OR dyslexia OR agraphia OR anomia OR aphasia OR dysphasia OR dysgraphia OR alexia OR aprosodia OR "cerebrovascular disorder"	2508

		OR "brain injury" OR "cerebral palsy" OR stroke OR "mental retardation" OR "intellectual disability" OR "intellectual disabilities" OR "intellectual deficiencies" OR "regulatory disorder" OR epilepsy OR "spina bifida" OR clumsy OR "coordination disorder" OR "motor skills disorder" OR "motor disorder" OR "perception disorder" OR dyspraxia OR apraxia OR "motor deficit" OR "sensory integrative dysfunction" OR "sensory modulation disorder" OR "sensory modulation dysfunction" OR "sensory processing disorder" OR hypersensitiv* OR hypotonia OR overresponsiv* OR oversensitiv* OR underresponsiv* OR "sensory defensiveness" OR "sensation seeking" OR "postural disorder" OR "emotional regulation" OR handwriting OR mutism OR "sensation disorder" OR "neuromuscular disorder" OR "sensory disorder" OR "sensory dysfunction" OR "sensory impairment" OR "childhood disintegrative disorder" OR "movement disorder") **Limits:** 1970–2012, Favorite journals*	
6/12/12	OT seeker	sensory integration OR sensory integrative OR auditory integration OR auditory integrative OR auditory training	55
6/12/12	OT seeker	Intervention: Sensation AND Age Group: Paediatric/Adolescent	16
6/12/12	OT seeker	Sensory OR sensorimotor OR tactile OR proprioceptive OR perceptual OR spatial Age Group: Paediatric/Adolescent	36
6/12/12	OT seeker	Vestibular OR massage OR Wilbarger OR snoezelen OR weighted vest OR multisensory OR berard OR tomatis OR samonas OR hypersensitive OR hypotonia OR overresponsive OR oversensitive OR underresponsive OR postural OR touch OR pressure OR brush Age Group: Paediatric/Adolescent	25
6/12/12	PEDro	Sensory integration	22
6/12/12	PEDro	Auditory integration	0
6/12/12	PEDro	Sensory AND Subdicipline: Paediatrics	40

6/12/12	PEDro	Speech AND Subdicipline: Paediatrics	8
6/12/12	PEDro	Communication AND Subdicipline: Paediatrics	12
6/12/12	PEDro	Language AND Subdicipline: Paediatrics	47
6/12/12	PEDro	Tactile AND Subdicipline: Paediatrics	24
6/12/12	PEDro	Vestibular	22
6/12/12	PEDro	Massage	61
6/14/12	PsycBITE	Target area: Language/Communication/Speech AND Intervention: Sensory/Perceptual/Visuospatial	10
6/14/12	PsycBITE	Intervention: Sensory/Perceptual/Visuospatial AND Age Group: Children, Adolescents	5
6/14/12	PsycBITE	Target Area: Sensory/Perceptual/Visuospatial AND Age Group: Children, Adolescents	4
6/14/12	PsycBITE	Sensory integration	2
6/14/12	PsycBITE	Auditory integration	2
6/14/12	REHABDATA	“sensory integration”	77
6/14/12	REHABDATA	“sensory integrative”	19
6/14/12	REHABDATA	“auditory integration”	10
6/14/12	REHABDATA	Massage AND (child OR children OR student OR adolescent)	3
6/14/12	REHABDATA	Snoezelen OR “weighted vest”	7
6/25/12	REHABDATA	Vestibular AND (child OR children OR student OR adolescent)	32
6/25/12	REHABDATA	Sensory AND speech AND (child OR children OR student OR adolescent)	59
6/25/12	REHABDATA	Proprioceptive AND (child OR children OR student OR adolescent)	19
6/25/12	REHABDATA	“sensory therapy” OR “sensory treatment” OR “sensory training” OR “sensory intervention”	12

6/25/12	REHABDATA	Multisensory AND (child OR children OR student OR adolescent)	23
6/25/12	REHABDATA	berard OR tomatis OR samonas OR hypersensitive OR hypotonia OR overresponsive OR oversensitive OR underresponsive	24
6/28/12	speechBITE	Sensory	44
6/28/12	speechBITE	Massage	5
6/28/12	speechBITE	Snoezelen	1
6/28/12	speechBITE	Multisensory	6
6/28/12	speechBITE	Auditory integration	7
6/28/12	speechBITE	Sensorimotor	12
6/28/12	speechBITE	Proprioceptive	1
6/28/12	speechBITE	Postural	8
6/28/12	speechBITE	Tactile	18
6/28/12	speechBITE	Touch	17
6/28/12	speechBITE	Vestibular	0
6/28/12	speechBITE	Weighted vest	0
6/28/12	speechBITE	Wilbarger	0
7/3/12	LILACS	sensory AND integrati$	48
7/3/12	LILACS	auditory AND integration	23
7/3/12	LILACS	massage AND child$	41
7/3/12	LILACS	multisensory OR snoezelen	3
7/3/12	LILACS	sensorimotor AND child$	22
7/3/12	LILACS	proprioceptive AND child$	8
7/3/12	LILACS	tactile AND child$	30
7/3/12	LILACS	touch AND speech	7

7/3/12	LILACS	vestibular AND speech	18
7/3/12	LILACS	Wilbarger OR vest	15
7/3/12	EHDI	Sensory (searched by word in title)	17
7/3/12	EHDI	Auditory integration	0
7/3/12	EHDI	Proprioceptive	1
7/3/12	EHDI	Auditory training	1
7/5/12	Highwire	"sensory integration therapy" **Limits:** 1970-2012	143
7/5/12	Highwire	"sensory integration treatment" **Limits:** 1970–2012	83
7/5/12	Highwire	"sensory integration training" **Limits:** 1970–2012	18
7/5/12	Highwire	"sensory integration intervention" **Limits:** 1970–2012	37
7/10/12	Highwire	"auditory integration" **Limits:** 1970–2012	236
7/12/12	Centre for Reviews and Dissemination Databases (CRD)	"sensory integration"	11
7/12/12	CRD	"auditory integration"	5
7/12/12	TRIP database	"sensory integration" OR "auditory integration"	172
7/16/12	Google Scholar	(speech OR audiologist OR language OR communication OR hearing) AND "sensory integration intervention" **Limits:** 1970–2012	156
7/17/12	Google Scholar	(speech OR audiologist OR language OR communication OR hearing) AND "sensory integration treatment"	318

		Limits: 1970–2012	
7/23/12	Google Scholar	speech OR audiologist OR language OR communication OR hearing "sensory integration training" **Limits:** 1970–2012	184
7/23/12 7/24/12 7/26/12	Google Scholar	speech OR audiologist OR language OR communication OR hearing "sensory integration therapy," "sensory integration training," "sensory integration intervention," "sensory integration treatment, "dissertation, "auditory integration," dementia –chapter 392 **Limits:** 1970–2012	1150
7/26/12 7/31/12	Google Scholar	"auditory integration treatment" OR "auditory integration therapy" OR "auditory integration training" OR "auditory integration intervention" **Limits:** 1970–2012	880

Additional Searches:

- The reference lists of all relevant articles identified were scanned for other possible studies.
- All accepted articles were forward-searched on ISI Web of Science and GoogleScholar.
- All ASHA journals were searched through the HighWire Press website.
- All publications in PubMed were searched by select authors: Bettison S; Edelson SM; Fallon MA; Kantner RM; Kawar M; Macauley BL; Monville, DK; Morrison D; Ray TC; Rimland B; Speier T; Tatum JM; Yencer KA; Zollweg, W.

The literature search was conducted from October 2011 to July 2012 by Laura Cannon. References were managed using the bibliographic software EndNote.

Appendix B. Description of quality indicators in the ASHA levels of evidence scheme

Indicator	Description
Adequate protocol description	Intervention protocol was described with sufficient detail to allow others to replicate the study.
Participant comparability/ adequate description	Groups/participants were comparable at baseline on important factors *(between-subject design)* or participant(s) were adequately described *(within-subject design).*
Assessor(s) blinded	Those assessing study outcomes were unaware of the practice of keeping investigators or participants ignorant to the group to which participants are assigned.
Adequate random sampling/allocation	The method(s) used to choose and assign participants to the experimental conditions in the study. Randomization procedures were described adequately.
Treatment fidelity	Steps were taken to ensure the treatment was delivered as intended.
Significance	*P*-values were reported or calculable.
Precision	Effect size and confidence interval were reported or calculable.
Intention to treat *(randomized controlled trials only)*	Participants analyzed according to the group they were initially assigned, regardless of whether or not they dropped out, fully complied with the treatment, or crossed over and received the other treatment.