CRITICALLY APPRAISED TOPIC

TITLE

Effectiveness of preschool intervention programs for students with autism?

AUTHOR

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CLINIAL SCENARIO

Autism Spectrum Disorder (ASD) is characterized by deficits in social skills and communication and restrictive and repetitive behavior patterns, interests, or activities, including a hyper-or hypo reaction to or unusual interest in sensory input in the environment. Social and communication skill deficits in ASD include the following: social-emotional reciprocity; nonverbal communicative behaviors used for social interaction; and developing and maintaining relationships (5th ed.; DSM–5; American Psychiatric Association, 2013). The Center for Disease Control and Prevention (2016) reported a prevalence rate of 1 in 68 children identified as having an autism spectrum disorder. Most children with ASD are diagnosed between 3 and 4 years of age with a median age of diagnosis of 3 years, 10 months. In a large epidemiological study, Nicholas, Carpenter, King, Jenner, & Charles (2009) found that 29.2% of 4-year old children with ASD were evaluated in a school setting and 76.9% were being served in special education. With such a significant number of preschool children with ASD receiving services in a school environment, it is imperative that preschool programs implement evidence-based interventions that have proven to be effective with this unique population. The following programs were identified in the literature and analyzed for this paper: applied behavior intervention (ABI); Joint Attention Symbolic Play Engagement and Regulation (JASPER); Theory of Mind (ToM); and Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH).

FOCUSED CLINICAL QUESTION

What is the existing evidence regarding the effectiveness of programs designed to improve functional performance of children with ASD in a preschool setting?

SUMMARY OF SEARCH
[Best evidence appraised and key findings]

This review includes 4 articles examining the impact of four different programs implemented in a preschool setting with children age 2 to 7 years. The first was a longitudinal study of the TEACCH program that compared 15 children receiving this intervention to 15 children in a control group receiving a non-specific approach. The results found a reduction in autistic symptoms and maladaptive behavior (D'Elia, Valeri, Sonnino, Fontana, Mammone, & Vicari, 2013). The second was a pilot study that analysed the effectiveness of the JASPER intervention on minimally verbal children with autism. The treatment group was compared to a control group receiving the usual treatment of ABA. The participants in the JASPER treatment group were found to have greater play diversity and were more engaged in the classroom (Goods, Ishijima, Chang, & Kasari, 2012). The third study was a systematic review examining the effectiveness of ABI by analysing the method and results of 13 studies that included randomized controlled trials, quasi-randomized controlled trials, and controlled trials. Measured outcomes included cognitive, language, or adaptive behavior. The review found inadequate evidence that that ABI has better outcomes than other standard forms of care (Spreckley & Boyd, 2009). The last study was also a systematic review of 22 studies that reviewed the efficacy of interventions based on the Theory of Mind (ToM) model for individuals with ASD. The articles included randomized controlled trial data. The results found some evidence that theory of mind can be taught to people with ASD but there is little evidence that this skill is maintained, generalized to other settings, or has an impact on related skills (Fletcher-Watson, Mcconnell, Manola, & Mcconachie, 2014).

CLINICAL BOTTOM LINE

Evidence was mixed on the effectiveness of the preschool programs reviewed. Cognitive and behavioral approaches that included ToM and ABI were found to be ineffective in producing lasting functional improvement. In comparison, interventions focusing more on engagement and play skills including TEACCH and JASPER resulted in decreased maladaptive symptoms and significant gains in play and engagement.

Important note on the limitation of this CAT

This critically appraised paper (or topic) has /has not been peer-reviewed by one other independent person/lecturer

SEARCH STRATEGY

Terms used to guide the search strategy

- **P**atient/Client Group: Preschool children age 2 to 7 with a diagnosis of autism spectrum disorder
- **I**ntervention (or Assessment): Searches were conducted using the terms: "autism AND preschool" and "occupational therapy AND autism AND preschool"
- **C**omparison: None required
- **O**utcome(s): all outcomes included that met patient and intervention search criteria

Databases and Sites Searched	Search Terms	Limits Used
OVID Medline	"autism AND preschool" and "occupational therapy AND autism AND preschool" "autism AND preschool' (title)	Limit to previous 10 years
PubMed	"occupational therapy AND autism AND preschool"	Limit to previous 10 years
CINAHL	'autism AND preschool AND occupational therapy'	Limit to previous 10 years

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria

1. Subjects age 2 to 7 years
2. Subjects with a diagnosis of autism spectrum disorder
3. Intervention implemented in a preschool setting
4. Systematic review or quantitative study with a control group
5. Article published within the previous 10 years

Exclusion Criteria

1. Studies that included diagnoses other than ASD
2. Qualitative studies
3. Articles not available in English
4. Articles published more than 10 years ago

RESULTS OF SEARCH

A total of _11__ relevant studies were located and categorised as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011)

Design Level	Sample Size Level
I=Randomized control trial/Systematic review II=Non-randomized control, two groups III=Non-randomized control trial, one group, pretest-posttest IV=Single-subject design NA=Narratives, case studies	A=n > 20 B=n <20

Table 1: Summary of Study Designs of Articles Retrieved

Study Design/Methodology of Articles Retrieved	Level	Number Located	Author (Yr)
Pilot Randomized Control Trial	IA	2	Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C., 2012
Systematic Review and Meta-Analysis	IA	2	Spreckley, M., & Boyd, R., 2009
Longitudinal Quasi-experimental	IIA	5	D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S., 2013
Quasi-experimental	IIA	5	Grindle, C. F., Hastings, R. P., Saville, M., Hughes, J. C., Huxley, K., Kovshoff, H., Griffith, G., Walker-Jones, E., Devonshire, K., Remington, B., 2012
Quasi-experimental	IIA	5	B. A., Hume, K. Mcbee, M. T., Alessandri, M., Gutierrez, A., Johnson, L., Sperry, L., Odom, S. L., 2013
Quasi-experimental	IIA	5	Kaale, A., Smith, L., & Sponheim, E., 2011
Quasi-experimental	IIA	5	Peters-Scheffer, N., Didden, R., Mulders, M., & Korzilius, H., 2010
One group pre-test/post-test	IIIA	1	Solomon, R., Necheles, J., Ferch, C., & Bruckman, D., 2007

ABAB Design	IIIB	3	Crozier, S., & Tincani, M. (2006).
Pilot Study One group pre-test/post-test	IIIB	3	Liao, S., Hwang, Y., Chen, Y., Lee, P., Chen, S., & Lin, L., 2014
ABA Design	IIIB	3	Marr, D., Mika, H., Miraglia, J., Roerig, M., & Sinnott, R., 2007

BEST EVIDENCE

The following study/paper was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this study were:

- ➢ High levels of evidence of randomized control trial or quasi-experimental level
- ➢ Representative of varied comprehensive preschool intervention programs
- ➢ Close adherence to inclusion criteria

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of TEACCH by D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S., 2013

D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S. (2013). A Longitudinal Study of the Teacch Program in Different Settings: The Potential Benefits of Low Intensity Intervention in Preschool Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders,44*(3), 615-626. doi:10.1007/s10803-013-1911-y

Aim/Objective of the Study/Systematic Review:
The objective of the study is to investigate the potential benefits of low intensity intervention based on the TEACCH program in natural settings and evaluate changes in parental stress levels and perception of the children's maladaptive behaviors.

Study Design
[eg systematic review, cohort, randomized controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]
Note:
For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc.
For qualitative studies, identify data collection/analyses methods
This was a longitudinal study. Participants were not randomly assigned. The assignment to the experimental or control group was chosen by parents. The study lasted 24 months. All participants were evaluated at baseline, 6 months, 12-15 months, and 24 months. An external multidisciplinary team made all assessments and were blind to treatment status.

Setting
[eg locations such as hospital, community; rural; metropolitan; country]

The study was conducted in Italy. Participants were recruited from a neuropsychiatry unit of a children's hospital. The control group attended mainstream schools. The experimental group received the TEACCH program treatment 2 hours at home and 2 hours at mainstream school.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (eg purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Participants included 30 children, 15 assigned to control group and 15 to the experimental group. The assignment to the experimental or control group was chosen by parents. Inclusion criteria were: diagnosis of AD or PDD NOS; age between 2.0 and 6.11 years; and no other major medical diagnosis. Each group was matched for age, gender, diagnosis, and severity of autism. The groups were compared and no significant differences were found in regard to age, gender, and autism severity based on ADOS assessment. Baseline mean outcome scores in cognitive functioning, language skills, behavioral functioning, parental stress, and psychopathological comorbidity showed no statistically significant differences.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control (CG)

Participants of both the control group and the experimental group attended mainstream schools in Italy where they received instruction from a support teacher 10-18 hours as determined by Italian law. The control group also received the usual treatment assigned to children with developmental disorders that included 2 hours of psychomotor therapy and 2 hours of speech therapy weekly.

Experimental (EG)

Participants of both the control group and the experimental group attended mainstream schools in Italy where they received instruction from a support teacher 10-18 hours as determined by Italian law. The experimental group also received the TEACCH program treatment of 2 hours at home and 2 hours at school.

Outcome Measures (Primary and Secondary)

Give details of each measure, maximum score for each measure and range, administered by whom, where

Participants were assessed by a multi-disciplinary team including neuropsychiatrists, child psychologists, and speech therapists. Diagnostic criteria was established using the DSM-IV and Autism Diagnostic Interview-Revised (ADI-R). The Griffith Mental Development Scales (GDMS-ER) was administered to determine the child's mental development level and the Psychoeducational Profile-Third Edition (PEP-3) to identify idiosyncratic learning patterns, both at baseline. The Autism Diagnostic Observation Schedule (ADOS) was administered at baseline, 6 months, and 24 months to address severity of autism. Adaptive behavior was evaluated using the Vineland Adaptive Behavior Scales (VABS); receptive and expressive communication was evaluated with the MacArthur Communication Developmental Inventories (CDI), and comorbid psychopathy was was evaluated using the Child Behavior Checklist (CBCL) at baseline, 6 months, 12-15 months, and 24 months. Outcome measures also included information provided by parents who completed the Parenting Stress Index-Short Form (PSI-SF).

Main Findings

[Insert table of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc where provided – if you need to calculate these data yourself put calculations here and add interpretation later, under 'critical appraisal' on next page]

Assessment	P-Value	Results
ADOS	P<0.001 P=0.048 (Cochran-Mantel-Haenszel test)	Statistically significant decrease in scores for both groups over time with lower means scores observed in the EG. EG: Percentage of participants classified with "autism" decreased from 53% to 13%. The percentage of participants classified as "autism spectrum" increased from 40% to 60%. Percentage of participants classified as "non-spectrum" from 7% to 27%. CG: Percentage of participants classified with "autism" decreased from 66% to 50%. %. The percentage of participants classified as "autism spectrum" increased from 27% to 43%. Percentage of participants classified as "non-spectrum" remained unchanged.
CDI	P<0.001	Both groups significantly improved over time both in comprehension and production with better improvements reported in EG.
VABS	P<0.001	Scores at baseline similar. Adaptive functioning results showed improvement in both groups for communication, daily living, socialization, and motor skills with higher scores found in the EG as compared to CG.
CBCL - Emotionally reactive Withdrawal Attention problems Anxiety problems Pervasive developmental Attention Deficit/Hyperactivity Internalizing problems Externalizing problems Total problems	 P=0.034 P<0.001, 0.002 P=0.002 P=0.009 P=0.044, <0.025 P=0.010 P=0.003,0.046 P=0.012 P<0.001, 0.045	Statistically significant differences between groups and over time. All mean scores decreased in both groups with lower mean in EG as compared to CG.
PSI – Parental Distress Parent-child difficult interaction	 P=0.01 0.005, 0.009	Both groups had decreased levels of parenting stress. Statistically significant results between groups were observed. The EG Parent-child difficulty interaction score strongly decreased and continued to

Commented [SL(2): As in not Autism? Don't need to use italics with non-spectrum.

Difficult Child	P=0.002	decrease after 2 years while the CG score remained unchanged. In the EG, parental distress continuously decreased over 2 years while no improvement was observed in the CG.
Total Score	P<0.001	
PEP-3 –		Statistically significant differences over time were found in the EG in almost all skills and behaviors with a large increase between baseline and 6 months and then stable or little change for remainder of study. The only skills that did not show a statistically significant improvement over time receptive language and personal self-care, although means did increase.
Cognitive Verbal/Preverbal	P=0.008	
Expressive Language	P<0.033	
Fine Motor	P<0.001	
Gross Motor	P=0.007	
Visual Motor Imitation	P=0.008	
Characteristic Motor Behaviors	P=0.004	
Characteristic Verbal Behaviors	P=0.02	

Original Authors' Conclusions

[paraphrase as required. If providing a direct quote, add page number]

Change occurred across time on the main outcome indicators of severity of autism, language, and adaptive functioning but there were no statistically significant differences between the CG and the EG. The authors identified the low intensity of the intervention as a possible reason for insignificant results as the recommendation for best practice with the TEACCH program is 20 hours per week for 2 years. Significant changes were found in ADOS classification with the ED showing significant improvement in all classifications as compared to the CG. This finding was hypothesized to be a result of the TEACCH method that intends to generalize structured teaching to all people and natural settings in the child's life. The secondary outcomes of parental stress and psychopathological comorbidity did show statistically significant differences with the EG showing reduced parental stress and improvement in symptomatology that was also maintained or further improved over time when compared to the CG. The study supports the feasibility of implementing a TEACCH program and demonstrates its potential educational benefits.

> **Commented [SL(3):** Experimental group?? (EG?)

Critical Appraisal

Validity

[Methodology, rigour, selection, bias, provide PEDro socre/PEDro partitioned score and sub-test items 1-10 for RCTs; other study designs, follow headings used in critical appraisal checklist forms.

Comment on missing information in original paper.

The subject criteria and methodology of the study was clearly explained and could be easily replicated. The assignment to the control or experimental group was not randomized and therefore the self-selection of groups by parents may have resulted in inequality. The sample size was relatively small and therefore one would need to be cautious in generalizing the findings. Valid and reliable outcome measures were utilized and the assessments were conducted by a multi-disciplinary team that wasere blind to the group assignment, increasing validity and limiting potential bias. Data was collected multiple times over the course of 2 years, allowing for the examination of change over time. All subjects remained in the study throughout so drop-out did not negatively impact the results. Normality was evaluated using the Shapiro-Wilk normality test and baseline groups were compared using a non-parametric Mann-Whitney U test. An ANOVA was used to determine the impact of time on the results and changes to ADOS scores were assessed using the Cochran-Mantel-Haenszel Chi squared test.

PEDro Scale Score: 7/11

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference – some of which you may have calculated yourself.
Email original authors for information needed such as additional data needed to calculate confidence intervals.
The study lacked randomization and had only a moderate sample size. However, the study methods and criteria were clearly defined and maintained throughout and potential bias was limited whenever possible. The outcome measures were valid and reliable, although no information was provided regarding inter-rater reliability. Hypothesis testing resulted in p-values most often under .05, indicating results of statistical significance. Overall, it was a high-quality study.
Summary/Conclusion
A low intensity home and school TEACCH program may reduce autistic symptoms and maladaptive behavior and provide benefits for preschool students with ASD.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Theory of Mind by Fletcher-Watson, S., Mcconnell, F., Manola, E., & Mcconachie, H., 2014

Fletcher-Watson, S., Mcconnell, F., Manola, E., & Mcconachie, H. (2014). Interventions based on the Theory of Mind cognitive model for autism spectrum disorder (ASD). *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd008785.pub2

Aim/Objective of the Study/Systematic Review:
The objective is to review the efficacy of interventions based on Theory of Mind (ToM) cognitive model for individuals with ASD.
Study Design
[eg systematic review, cohort, randomized controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]
Note:
For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc.
For qualitative studies, identify data collection/analyses methods
This study is a systematic review of 22 randomized trials.
Setting
[eg locations such as hospital, community; rural; metropolitan; country]
The settings varied based on the study. All educational settings that met criteria were included.
Participants
[N, diagnosis, eligibility criteria, how recruited, type of sample (eg purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were

comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Selection criteria included an applicable Theory of Mind intervention, new randomized controlled trial data presented, and participants with a confirmed diagnosis of autism spectrum disorder. Studies were selected by two authors independently with a 3rd stepping in to arbitrate as necessary. Participants varied in age from preschool to adults but a majority focused on preschool or primary school age children. Almost half of the study participants had normal intelligence as measured by while participants in the remaining studies reported participants with intellectual disability.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

All studies included in the review contained a control group. Control groups included treatment as usual, wait lists, activities without therapeutic intervention, and placebo intervention such as watching Thomas the Tank Engine DVDs.

Experimental

All experimental group interventions either explicitly taught Theory of Mind, "the ability to understand each other's thoughts, beliefs, and other internal states" (p. 10) or taught precursor skills include joint attention, imitation, and emotion recognition.

Outcome Measures (Primary and Secondary)

Give details of each measure, maximum score for each measure and range, administered by whom, where

Many studies confirmed diagnosis with a baseline Autism Diagnostic Observation Schedule (ADOS) or Childhood Autism Rating Scale (CARS). Most studies included multiple outcome measures. The type of primary assessment measures included the following categories:

-Recognition of emotion

-Joint attention and joint engagement

-Direct assessment of ToM abilities

-Imitation skills

Diagnostic outcome

Secondary outcome measures included:

-Caregiver measures

-Social skills

-Symbolic play

-Language

-Functional magnetic resonance imaging

-Adaptive function

Main Findings

[Insert table of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc where provided – if you need to calculate these data yourself put calculations here and add interpretation later, under 'critical appraisal' on next page]

Communication: Two studies evaluated communication: Improvements in vocalization directed to others, gestures, pointing in the intervention group (median difference = 4 points), but not in the control group (median difference = 2.5 points); No intervention effects for change in eye contact and gaze aversion and no effect of intervention on conversational skills.

Social function: Six studies evaluated social function. Differences in measurement prevented combining all studies for meta-analysis. Three studies were combined for analysis with the following results: SMD 0.23, 95% CI -0.48 to 0.94, Z = 0.63, P value = 0.53. Among studies not included in meta-analysis, large treatment gains were found in showing and responding to joint attention.

Original Authors' Conclusions

[paraphrase as required. If providing a direct quote, add page number]

There is some evidence that people with ASD can be taught ToM but there is little evidence that this skill can be maintained, generalized to other skills, or that is has a significant impact on functional performance. Current evidence was also rated to be "low or "very low" in quality due to inadequate information and lack of blinding or randomization.

Critical Appraisal

Validity

[Methodology, rigour, selection, bias, provide PEDro score/PEDro partitioned score and sub-test items 1-10 for RCTs; other study designs, follow headings used in critical appraisal checklist forms.

Comment on missing information in original paper.

All studies in this review were determined to be randomized. Half of the studies were found to have a "low" risk of bias in this area. The majority of studies (19/22) were found to be at high risk for bias due to lack of blinding. Only 3/22 studies were a high risk of bias due to drop out and/or incomplete outcome data. Overall, current evidence was also rated to be "low" or "very low" in quality.

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference – some of which you may have calculated yourself.

Email original authors for information needed such as additional data needed to calculate confidence intervals.

Meta-analysis was conducted on data when possible. Studies reviewed in this article used a wide variety of outcomes that made analysis difficult. Effect sizes, mean differences, and confidence intervals were not always reported.

Communication: No intervention effects for change in eye contact and gaze aversion and no effect of intervention on conversational skills.

Social function: Large treatment gains were found in showing and responding to joint attention.

Summary/Conclusion

The review indicates that Theory of Mind (ToM) and related skills can be taught to people with ASD but there is insufficient evidence to suggest that these skills are maintained, generalized, or

applied to functional tasks. Future research should investigate the results of multi-modal interventions that teach a range of real-world social and communicative skills as well as academic learning.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of JASPER by Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C., 2012

Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C. (2012). Preschool Based JASPER Intervention in Minimally Verbal Children with Autism: Pilot RCT. *Journal of Autism and Developmental Disorders,43*(5), 1050-1056. doi:10.1007/s10803-012-1644-3

Aim/Objective of the Study/Systematic Review:
The goal of this study is to determine if a JASPER intervention focused on a developmentally based approach for teaching engagement, joint attention, and play skills can improve social communication outcomes for minimally verbal children with ASD.

Study Design
[eg systematic review, cohort, randomized controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]
Note:
For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc.
For qualitative studies, identify data collection/analyses methods
This is a randomized experimental study with a control group and an experimental group with assessments conducted at baseline, 12 weeks later at entry, and following intervention.

Setting
[eg locations such as hospital, community; rural; metropolitan; country]
The recruitment and intervention setting was a non-public autism specialty school.

Participants
[N, diagnosis, eligibility criteria, how recruited, type of sample (eg purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]
Participants included 15 preschool children age 3-5 years old with a clinical diagnosis of autism. They attended a non-public school and were reported to have less than 10 spontaneous, functional, and communicative words. The average age was 51.9 months and mental age was 15.45 months. The sample was ethnically diverse with over half of the subjects identified as minorities.

Intervention Investigated
[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control (CG)
Participants assigned to the CG received the regular school program of 30 hours per week of instruction.

Experimental (EG)
Participants in the EG were pulled out of their regular school program instruction to receive intervention for 30 minutes twice a week for 12 weeks to work on communicative gestures in a play-based treatment. Graduate students in educational psychology provided intervention.

Outcome Measures (Primary and Secondary)

Give details of each measure, maximum score for each measure and range, administered by whom, where

The outcome measures included:

-Autism Diagnostic Observation Scale (ADOS) was used to confirm diagnosis and Mullen Scales of Early Learning was used to assess mental age, developmental quotient, and subscales of development at baseline. -Structured Play Assessment (SPA), an experimental measure of play, was completed at baseline, entry, and exit. It was completed by an independent assessor.

-Early Social Communication Scales (ESCS) was completed at baseline, entry, and exit and was designed to elicit spontaneous gestures. It was administered by an assessor blind to intervention.

-Classroom Observation Measure was conducted at entry and exit during 20 minutes of free play in the classroom. It is designed to observe engagement states and spontaneous communicative gestures. Coders were blind to the intervention.

> **Commented [SL(4):** Probably should cite these tools…

Main Findings

[Insert table of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc where provided – if you need to calculate these data yourself put calculations here and add interpretation later, under 'critical appraisal' on next page]

Due to small sample size, non-parametric statistics were used. A Kruskal-Wallis test was used to determine initial differences between groups. The Wilcoxon signed-ranks test was conducted to analyse group differences at exit. The CG did not have change on any of the outcome variables. Data on the EG outcomes between entry and exit is found below:

	Z-Score	P-value	SE$_{diff}$	Outcome
Play types	-2.03	0.04	3.71	80% had reliable increases in play types
Percent of time unengaged	-2.02	0.04	8.80	80% reliably decreased in time unengaged
Frequency of requesting gestures	-1.36	0.18	1.31	40% significantly increased gestures-no significant change

Original Authors' Conclusions

[paraphrase as required. If providing a direct quote, add page number]

This pilot study shows that the JASPER program has potential for improving play and engagement for children identified as nonverbal and making limited progress within a short period of time with a low dose of intervention.

Critical Appraisal

Validity
[Methodology, rigour, selection, bias, provide PEDro socre/PEDro partitioned score and sub-test items 1-10 for RCTs; other study designs, follow headings used in critical appraisal checklist forms.   Comment on missing information in original paper.
Randomization of subjects reduced the risk of selection bias. The study included multiple standardized valid and reliable outcome measures with 4 different data collection points during the study. The methods were clearly explained, allowing for replication. Analysis was conducted on the results to determine statistical significance. The study included a small sample size, something that should be considered before generalizing the results. All subjects remained in the study throughout so drop-out did not negatively impact the results.   PEDro Scale Score: 7/11

Interpretation of Results
[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference – some of which you may have calculated yourself.   Email original authors for information needed such as additional data needed to calculate confidence intervals.
The subjects were randomly assigned but no one was blinded to group assignment during treatment or assessment. The sample size was small. The study methods and criteria were clearly defined and maintained throughout and potential bias was limited whenever possible. The outcome measures were valid and reliable. Hypothesis testing was reported with most p-values under .05, indicating results of statistical significance. Overall, it was a high-quality study.

Summary/Conclusion
Participants in the JASPER treatment group demonstrated greater play diversity, initiated more gestures, and spent less time unengaged as compared to the control group, even with the low duration and intensity of two 30 minutes sessions a week for 12 weeks. This indicates that even short term, targeted interventions can have a positive impact on joint attention and play.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Applied Behavior Intervention (ABI) by Spreckley, M., & Boyd, R., 2009

Spreckley, M., & Boyd, R. (2009). Efficacy of Applied Behavioral Intervention in Preschool Children with Autism for Improving Cognitive, Language, and Adaptive Behavior: A Systematic Review and Meta-analysis. *The Journal of Pediatrics,154*(3), 338-344. doi:10.1016/j.jpeds.2008.09.012

Aim/Objective of the Study/Systematic Review:

The aim of the systematic review was to determine the efficacy of Applied Behavior Intervention (ABI) for improving cognition, communication, and adaptive behavior in preschool children with ASD.

Study Design

[eg systematic review, cohort, randomized controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note:

For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc.

For qualitative studies, identify data collection/analyses methods

This study is a systematic review of 13 articles including systematic reviews, randomized controlled trials, quasi-randomized controlled trials, or controlled trials.

Setting

[eg locations such as hospital, community; rural; metropolitan; country]

The articles reviewed had studies that were all conducted in either school or home-based settings.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (eg purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Selection criteria included preschool children between 18 months and 6 years with a diagnosis of ASD or PDD, interventions including ABI approaches to behavioral management; interventions delivered to family/caregivers or child by special educators, teachers, speech pathologists, psychologists, or allied health professional students; and outcomes in the areas of cognition, language, or adaptive behavior. Two authors evaluated the articles independently. They were rated with the PEDro scale of quality. Studies rated 6 or more were considered to have internal validity for quantitative meta-analysis.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control (CG)

In all the studies, the CG also received some level of intervention or a combination of interventions as recommended by the child's multidisciplinary team. No study had a true control group.

Experimental EG)

EG's differed based on each individual study. Interventions were conducted at home and in the school setting. Intervention varied from 18 to 39 hours weekly with durations from 3 months to 3 years. Intervention was provided by teachers, aides, therapists, and student therapists.

Outcome Measures (Primary and Secondary)

Give details of each measure, maximum score for each measure and range, administered by whom, where

Outcome measures identified in the studies included the following:

-Intellectual functioning

-Language

-Adaptive

-Socioemotional

-Academic

-Cognitive

-Parent evaluation

Main Findings

[Insert table of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc where provided – if you need to calculate these data yourself put calculations here and add interpretation later, under 'critical appraisal' on next page]

The results of the studies that received meta-analysis are summarized below:

Outcome	Standardized Mean Difference	95% Confidence Interval	P-Value
Cognitive	0.38	-0.09 to 0.84	.1
Language-Expressive	0.37 0.97	-0.09 to 0.84 0.14 to 1.81	.11
Language-Receptive	0.29	-0.17 to 0.74	.22
Adaptive Behavior	0.30	-0.16 to 0.77	.20

Original Authors' Conclusions

[paraphrase as required. If providing a direct quote, add page number]

The analysis of the studies reviewed indicate that ABI interventions did not result in significant improvements in cognition, language, and adaptive behavior as compared to standard care. Of the 13 articles retrieved, only 4 met inclusion criteria due to low levels of evidence in the other studies.

Critical Appraisal

Validity

[Methodology, rigour, selection, bias, provide PEDro socre/PEDro partitioned score and sub-test items 1-10 for RCTs; other study designs, follow headings used in critical appraisal checklist forms.

Comment on missing information in original paper.

Of the 13 studies retrieved that met inclusion criteria in this systematic review, 6 were RCTs or quasi-RCTs with a PEDro score greater than or equal to 6 and of these six, only 4 had adequate data for meta-analysis. The PEDro scores were as follows: 4, 6, 8, 5, 7, 6, 4, 7, 5, 5, 4, 6, 6.

Commented [SL(5): OK...but not real helpful unless the author/year citation for the articles were included.

Interpretation of Results

[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference – some of which you may have calculated yourself.

Email original authors for information needed such as additional data needed to calculate confidence intervals.

Only 4 of the 13 studies reviewed for this article included studies high quality enough to allow for meta-analysis, indicating a need for more rigorous studies. The meta-analysis also had limitations due to high variability in methods and outcome measures, difficulty establishing control groups, lack of treatment standardization, little uniformity, limited information on subject retention, and lack of strict inclusion and exclusion criteria.

Summary/Conclusion

"Current evidence does not support ABI as a superior intervention for children with ASD. The instruments used to measure change were primarily discriminative and secondarily evaluative; these may not be able to detect low level changes" (p. 342).

Table [x]: Characteristics of included studies

	Study 1	**Study 2**	**Study 3**	**Study 4**
	D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S. (2013)	Fletcher-Watson, S., Mcconnell, F., Manola, E., & Mcconachie, H. (2014)	Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C. (2012)	Spreckley, M., & Boyd, R. (2009)
Intervention investigated	Benefits of low intensity intervention based on the TEACCH program in natural settings and evaluate changes in parental stress levels and perception of the children's maladaptive behaviors	Systematic review to examine the efficacy of interventions based on Theory of Mind cognitive model for individuals with ASD	Determine if an intervention focused on a developmentally based approach for teaching engagement, joint attention, and play skills (JASPER) can improve social communication outcomes for minimally verbal children with ASD	Systematic review of 13 articles including systematic reviews, randomized controlled trials, quasi-randomized controlled trials, or controlled trials
Comparison intervention	Control group and the experimental group attended mainstream schools in Italy where they received instruction from a support teacher 10-18 hours as determined by	All studies in the review contained a control group. Treatment as usual and wait list control groups were excluded.	Participants assigned to the control group received the regular school program of 30 hours per week of instruction.	In all the studies, the CG also received some level of intervention or a combination of interventions as recommended by the child's multidisciplinary team. No study

	Italian law. The control group also received the usual treatment assigned to children with developmental disorders that included 2 hours of psychomotor therapy and 2 hours of speech therapy weekly.			had a true control group.
Outcomes used	DSM-IV Autism Diagnostic Interview-Revised (ADI-R). Griffith Mental Development Scales (GDMS-ER) Psychoeducational Profile-Third Edition (PEP-3 Autism Diagnostic Observation Schedule (ADOS) Vineland Adaptive Behavior Scales (VABS) MacArthur Communication Developmental Inventories (CDI), Child Behavior Checklist (CBCL) Parenting Stress Index-Short Form (PSI-SF)	Outcome measures assessed the following skills: -Recognition of emotion -Joint attention and joint engagement -Direct assessment of ToM abilities -Imitation skills Diagnostic outcome Secondary outcome measures included: -Caregiver measures -Social skills -Symbolic play -Language -Functional magnetic resonance imaging -Adaptive function	Autism Diagnostic Observation Scale (ADOS) Mullen Scales of Early Learning Structured Play Assessment (SPA) -Early Social Communication Scales (ESCS) Classroom Observation Measure	Outcome measures assessed the following skills: -Intellectual functioning -Language -Adaptive -Socioemotional -Academic -Cognitive -Parent evaluation
Findings	No statistically significant differences between the CG and the EG. Significant changes were found in ADOS classification with the ED showing significant improvement in all	Communication: Improvements in vocalisation directed to others, gestures, pointing in the intervention group but not in the control group (median difference = 2.5 points); No intervention effects for change	Play types: 80% had reliable increases in play types Percent of time unengaged: 80% reliably decreased in time unengaged Frequency of requesting gestures: 40%	The outcomes and mean differences are below: Cognitive: 0.38 Language-Expressive: 0.37, 0.97 Language-Receptive: 0.29

classifications as compared to the CG. Secondary outcomes of parental stress and psychopathological comorbidity showed statistically significant differences with the EG showing reduced parental stress and improvement in symptomatology that was also maintained or further improved over time when compared to the CG.	in eye contact and gaze aversion and no effect of intervention on conversational skills. Social function: Differences in measurement prevented combining all studies for meta-analysis. Three studies were combined for analysis with the following results: SMD 0.23, 95% CI -0.48 to 0.94, Z = 0.63, P value = 0.53. Among studies not included in meta-analysis, large treatment gains were found in showing and responding to joint attention.	significantly increased gestures- no significant change	Adaptive Behavior: 0.30

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S. (2013)

A low intensity home and school TEACCH program may reduce autistic symptoms and maladaptive behavior and provide benefits for preschool students with ASD.

Fletcher-Watson, S., Mcconnell, F., Manola, E., & Mcconachie, H. (2014)

There is some evidence that people with ASD can be taught ToM but there is little evidence that this skill can be maintained, generalized to other skills, or that is has a significant impact on functional performance. Current evidence was also rated to be "low" or "very low" in quality.

Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C. (2012)

This pilot study shows that the JASPER program has potential for improving play and engagement for children identified as nonverbal and otherwise making limited progress, within a short period of time with a low dose of intervention.

Spreckley, M., & Boyd, R. (2009)

Existing evidence does not support ABI as being a highly effective intervention for children with ASD. Current research involves primarily low-level evidence so more rigorous studies are needed.

REFERENCES

Boyd, B. A., Hume, K., Mcbee, M. T., Alessandri, M., Gutierrez, A., Johnson, L., Sperry, L., Odom, S. L. (2013). Comparative Efficacy of LEAP, TEACCH and Non-Model-Specific Special Education Programs for Preschoolers with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders,44*(2), 366-380. doi:10.1007/s10803-013-1877-9

Community Report on Autism (Rep.). (2016). Retrieved June 26, 2017, from The Center for Disease Control (CDC) website: https://www.cdc.gov/ncbddd/autism/documents/community_report_autism.pdf

Crozier, S., & Tincani, M. (2006). Effects of Social Stories on Prosocial Behavior of Preschool Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders,37*(9), 1803-1814. doi:10.1007/s10803-006-0315-7

D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S. (2013). A Longitudinal Study of the Teacch Program in Different Settings: The Potential Benefits of Low Intensity Intervention in Preschool Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders,44*(3), 615-626. doi:10.1007/s10803-013-1911-y

Diagnostic and statistical manual of mental disorders: DSM-5. (2013). Washington, Londres: American Psychiatric Association.

Fletcher-Watson, S., Mcconnell, F., Manola, E., & Mcconachie, H. (2014). Interventions based on the Theory of Mind cognitive model for autism spectrum disorder (ASD). *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd008785.pub2

Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C. (2012). Preschool Based JASPER Intervention in Minimally Verbal Children with Autism: Pilot RCT. *Journal of Autism and Developmental Disorders,43*(5), 1050-1056. doi:10.1007/s10803-012-1644-3

Grindle, C. F., Hastings, R. P., Saville, M., Hughes, J. C., Huxley, K., Kovshoff, H., Griffith, G., Walker-Jones, E., Devonshire, K., Remington, B. (2012). Outcomes of a Behavioral Education Model for Children With Autism in a Mainstream School Setting. *Behavior Modification,36*(3), 298-319. doi:10.1177/0145445512441199

Kaale, A., Smith, L., & Sponheim, E. (2011). A randomized controlled trial of preschool-based joint attention intervention for children with autism. *Journal of Child Psychology and Psychiatry,53*(1), 97-105. doi:10.1111/j.1469-7610.2011.02450.x

Liao, S., Hwang, Y., Chen, Y., Lee, P., Chen, S., & Lin, L. (2014). Home-based DIR/Floortime™ Intervention Program for Preschool Children with Autism Spectrum Disorders: Preliminary Findings. *Physical & Occupational Therapy In Pediatrics,34*(4), 356-367. doi:10.3109/01942638.2014.918074

Marr, D., Mika, H., Miraglia, J., Roerig, M., & Sinnott, R. (2007). The Effect of Sensory Stories on Targeted Behaviors in Preschool Children with Autism. *Physical & Occupational Therapy In Pediatrics,27*(1), 63-79. doi:10.1300/j006v27n01_05

Nicholas, J. S., Carpenter, L. A., King, L. B., Jenner, W., & Charles, J. M. (2009). Autism Spectrum Disorders in Preschool-Aged Children: Prevalence and Comparison to a School-Aged Population. *Annals of Epidemiology,19*(11), 808-814. doi:10.1016/j.annepidem.2009.04.005

Peters-Scheffer, N., Didden, R., Mulders, M., & Korzilius, H. (2010). Low intensity behavioral treatment supplementing preschool services for young children with autism spectrum disorders and severe to mild intellectual disability. *Research in Developmental Disabilities,31*(6), 1678-1684. doi:10.1016/j.ridd.2010.04.008

Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism. *Autism,11*(3), 205-224. doi:10.1177/1362361307076842

Spreckley, M., & Boyd, R. (2009). Efficacy of Applied Behavioral Intervention in Preschool Children with Autism for Improving Cognitive, Language, and Adaptive Behavior: A Systematic Review and Meta-analysis. *The Journal of Pediatrics,154*(3), 338-344. doi:10.1016/j.jpeds.2008.09.012

Liao, S., Hwang, Y., Chen, Y., Lee, P., Chen, S., & Lin, L. (2014). Home-based DIR/Floortime™ Intervention Program for Preschool Children with Autism Spectrum Disorders: Preliminary

Findings. *Physical & Occupational Therapy In Pediatrics,34*(4), 356-367. doi:10.3109/01942638.2014.918074

Excellent review. Minor citatation/referencing….