What Works Clearinghouse

ies INSTITUTE OF EDUCATION SCIENCES

Early Childhood Education Interventions for Children with Disabilities August 2010

Lovaas Model of Applied Behavior Analysis

Program Description[1]

The *Lovaas Model of Applied Behavior Analysis* is a type of behavioral therapy that initially focuses on discrete trials: brief periods of one-on-one instruction, during which a teacher cues a behavior, prompts the appropriate response, and provides reinforcement to the child. Children in the program receive an average of 35 to 40 hours of intervention per week, which consists of in-home one-to-one instruction, facilitated peer play, inclusion and support in regular education classrooms, and generalization activities for transfer of skills to natural environments. In addition, parents are trained in instructional techniques. The intervention generally lasts about three years.

Research[2]

One study of the *Lovaas Model of Applied Behavior Analysis* (hereafter the *Lovaas Model*) that falls within the scope of the Early Childhood Education Interventions for Children with Disabilities review protocol meets What Works Clearinghouse (WWC) evidence standards, and one study meets WWC evidence standards with reservations. The two studies included 51 children in two locations ages 18 to 42 months with autism or pervasive developmental disorder.[3]

Based on these two studies, the WWC considers the extent of evidence for the *Lovaas Model* for children with disabilities to be small for cognitive development, communication/language competencies, social-emotional development and behavior, and functional abilities. No studies that meet WWC evidence standards with or without reservations examined the effectiveness of the *Lovaas Model* on children with disabilities in the literacy, math competencies, or physical well-being domains.

1. The descriptive information for this program was obtained from publicly available sources: the program's website (http://www.lovaas.com, downloaded February 2010) and the literature reviewed for this report. The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review. The literature search reflects documents publicly available by February 2010.
2. The studies in this report were reviewed using WWC Evidence Standards, Version 2.0 (see the WWC Procedures and Standards Handbook, Chapter III), as described in protocol Version 2.0.
3. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.

Effectiveness

The *Lovaas Model* was found to have potentially positive effects on cognitive development for children with disabilities and no discernible effects for communication/language competencies, social-emotional development/behavior, and functional abilities. No studies that meet WWC evidence standards with or without reservations examined the effectiveness of the *Lovaas Model* on children with disabilities in the literacy, math competencies, or physical well-being domains.

	Cognitive development	*Communication/ language competencies*	*Literacy*	*Math competencies*	*Social-emotional development/ behavior*	*Functional abilities*	*Physical well-being*
Rating of effectiveness	Potentially positive	No discernible effects	na	na	No discernible effects	No discernible effects	na
Improvement index[4]	+27 percentile points	Average: –3 percentile points	na	na	Average: +7 percentile points	+4 percentile points	na
		Range: –4 to –3 percentile points	na	na	Range: +2 to +14 percentile points		na

na = not applicable

Additional program information

Developer and contact

The *Lovaas Model* was developed in the Psychology Department of the University of California–Los Angeles under the direction of O. Ivar Lovaas, Ph.D. Clinic and consultation-based services are currently available through the Lovaas Institute (http://www.lovaas.com/contact.php).

Scope of use

The Lovaas Institute currently operates 12 centers nationwide and has certified consultants across the country. In addition, 11 sites around the world were chosen to participate in research originally funded by the National Institute of Mental Health to replicate the research published by Lovaas. The results of the research are being analyzed as part of the Multi-Site Young Autism Grant.

Teaching

During the first stages of the intervention, the main method of teaching is discrete trial training, which includes brief periods of instruction when a teacher cues a specific behavior, assists the child in providing an appropriate response, and provides reinforcement to the child. As children progress, therapists gradually increase the emphasis on instruction in less structured or more natural settings, such as peer play and classrooms.[5]

The early stages of the intervention focus on reducing behaviors that interfere with learning (e.g., self-stimulatory and

4. These numbers show the average and range of student-level improvement indices for all findings across the studies.
5. Lovaas, O. I., & Smith, T. (2003). Early and intensive behavioral intervention in autism. In A. Kazdin & J. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 325–340). New York: Guilford Press.

Additional program information *(continued)*

aggressive behaviors), teaching appropriate replacement behaviors, and teaching prerequisite skills necessary for subsequent progress (such as requesting, toy play, imitation, following simple instructions). As a child progresses, instruction advances to focus on development of expressive and receptive language skills, followed by social and conversation skills, such as topic maintenance and asking appropriate questions. Finally, pre-academic skills such as early reading and writing and observational learning skills are taught, with programming for generalization of all skills to preschool and other community settings.[6]

A typical therapy session lasts two to three hours. Short periods of structured time are devoted to a task, such as appropriate toy play or following instructions, and each session is followed by a short break. A longer break is provided at the end of every hour and used for incidental teaching or generalization activities.

The intervention team consists of one-to-one instructors, trainers, and supervisors. A team of three to five trained instructors delivers the majority of teaching in a child's home. One or two instructors on the team are responsible for training other instructors as well as monitoring the child's progress. All members of the intervention team are supervised by a case supervisor and program director.[7]

Cost[8]

One study estimates initial costs that range between $45,575 and $69,050 annually.[9]

Research

Fifty-eight studies reviewed by the WWC investigated the effects of the *Lovaas Model* on children with disabilities. One study (Sallows & Graupner, 2005) is a randomized controlled trial that meets WWC evidence standards. One study (Smith, Groen, & Wynn, 2000) is a randomized controlled trial with severe attrition that meets WWC evidence standards with reservations. The remaining 56 studies do not meet either WWC evidence standards or eligibility screens.

Meets evidence standards

Sallows and Graupner (2005) randomly assigned students to receive the *Lovaas Model* with a trained therapist or a parent-directed treatment using the Lovaas methods. Twenty-three children participated in the study, which examined cognitive development, communication and language competencies, social-emotional development and behavior, and functional abilities.[10]

Meets evidence standards with reservations

The study by Smith et al. (2000) was conducted in the Los Angeles area with 28 children with autism or a pervasive developmental disorder not otherwise specified. The study compared the cognitive development of children in the treatment group, who received 30 hours per week of the *Lovaas Model* with trained student therapists, to children in the parent-training group, whose parents were taught the same methods used in the *Lovaas Model*.[10]

6. Smith, T., Mruzek, D. W., & Peyton, R. T. (2008). A study in perseverance: The emergence of early intensive behavioral intervention. In E. Cippani (Ed.), *Triumphs in early autism treatment* (pp. 151–170). New York: Springer.
7. The Lovaas Institute: http://www.lovaas.com/services_clinic.php.
8. The WWC converted costs to 2010 dollars using the consumer price index.
9. Jacobson, J. W., Mulick, J. A., & Green, G. (1998). Cost-benefit estimates for early intensive behavioral intervention for young children with autism—general model and single state case. *Behavioral Interventions*, *13*(4), 201–226.
10. The study included other outcomes, which are excluded from this report because baseline equivalence was not established or required the use of adjustments, or the outcomes did not meet the topic area criteria for acceptable outcomes.

Research *(continued)*

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or medium to large (see the WWC Procedures and Standards Handbook, Appendix G). The extent of evidence takes into account the number of studies and the total sample size across the studies that meet WWC evidence standards with or without reservations.[11]

The WWC considers the extent of evidence for the *Lovaas Model* on children with disabilities to be small for cognitive development, communication/language competencies, social-emotional development and behavior, and functional abilities. No studies that meet WWC evidence standards with or without reservations examined the effectiveness of the *Lovaas Model* on children with disabilities in the literacy, math competencies, or physical well-being domains.

Effectiveness

Findings

The WWC review of interventions for Early Childhood Education for Children with Disabilities addresses student outcomes in seven domains: cognitive development, communication and language competencies, literacy, math competencies, social-emotional development and behavior, functional abilities, and physical well-being. The studies included in this report cover four domains: cognitive development, communication/language competencies, social-emotional behavior and development, and functional abilities. The findings below present the authors' estimates and WWC-calculated estimates of the size and the statistical significance of the effects of the *Lovaas Model* on children with disabilities.[12]

Cognitive development. Smith et al. (2000) reported a statistically significant difference on intellectual functioning favoring children in the treatment group. According to the WWC calculations, this difference was not statistically significant, but the effect size was substantively important according to WWC criteria (that is, at least 0.25). According to the WWC criteria, the *Lovaas Model* has potentially positive effects on cognitive development for children with disabilities.

Communication/language competencies. Sallows and Graupner (2005) examined two outcomes. The authors found, and the WWC confirmed, that neither effect was statistically significant. Neither effect size was large enough to be considered substantively important according to WWC criteria. According to the WWC criteria, the *Lovaas Model* has no discernible effects on communication/language competencies for children with disabilities.

Social-emotional development and behavior. Sallows and Graupner (2005) examined three outcomes in this domain. Although none of the impacts in this domain were statistically significant, one finding was large enough to be considered substantively important according to WWC criteria. The mean effect size across all three outcomes was not large enough to be considered substantively important, and thus the WWC found the *Lovaas Model* to have no discernible effects on social-emotional development and behavior for children with disabilities.

Functional abilities. Sallows and Graupner (2005) examined one functional ability outcome. The authors found, and the WWC confirmed, that the effect was not statistically significant nor was the effect size large enough to be considered substantively important according to WWC criteria. Thus, the WWC concludes that the *Lovaas Model* has no discernible effects on functional abilities for children with disabilities.

11. The extent of evidence categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept—external validity, such as the students' demographics and the types of settings in which studies took place—are not taken into account for the categorization. Information about how the extent of evidence rating was determined for the *Lovaas Model* is in Appendix A5.
12. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. For the *Lovaas Model* studies summarized here, no corrections for clustering or multiple comparisons were needed. However, Smith et al. (2000) used a one-tailed test for the outcome data, whereas the WWC uses a two-tailed test, so the significance levels may differ from those reported in the original study.

Effectiveness *(continued)*

Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings, the size of the difference between participants in the intervention and the comparison conditions, and the consistency in findings across studies (see the WWC Procedures and Standards Handbook, Appendix E).

The WWC found the *Lovaas Model* to have potentially positive effects for cognitive development for children with disabilities and no discernible effects for communication/language competencies, social-emotional development/behavior, and functional abilities

Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see WWC Procedures and Standards Handbook, Appendix F). The improvement index represents the difference between the percentile rank of the average student in the intervention condition and the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is entirely based on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analysis. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.

The improvement index for cognitive development is +27 percentile points based on one finding in one study. For communication/language competencies, the average improvement index is –3 percentile points in one study, with a range of –4 to –3 percentile points across findings. The average improvement index is +7 for the social-emotional development/behavior domain in one study, with a range of +2 to +14 percentile points across findings. The improvement index for functional abilities is +4 percentile points from one finding in one study.

Summary

The WWC reviewed 58 studies on the *Lovaas Model* for children with disabilities. One study meets WWC evidence standards; one study meets WWC evidence standards with reservations; the remaining 56 studies do not meet either WWC evidence standards or eligibility screens. Based on the two studies, the WWC found potentially positive effects on cognitive development for children with disabilities and no discernible effects on communication/language competencies, social-emotional development/behavior, and functional abilities. The conclusions presented in this report may change as new research emerges.

References

Meets WWC evidence standards

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation, 110*(6), 417–438.

Meets WWC evidence standards with reservations

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105*(4), 269–285.

Studies that fall outside the Early Childhood Education Interventions for Children with Disabilities review protocol or do not meet WWC evidence standards

Anderson, S. R., Avery, D. L., DiPietro, E. K., & Edwards, G. L. (1987). Intensive home-based early intervention with autistic children. *Education & Treatment of Children, 10*(4), 352–366. The study is ineligible for review because it does not occur within the time frame specified in the protocol.

Bailey, K. J. (2000). Social competence of children with autism classified as best-outcome following behavior analytic treatment (Doctoral dissertation, Washington State University).

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Dissertation Abstracts International, 61(12B), 82–6696. The study is ineligible for review because it does not disaggregate findings for the age or grade range specified in the protocol.

Bassett, K., Green, C. J., & Kazanjian, A. (2000). *Autism and Lovaas treatment: A systematic review of effectiveness evidence*. Vancouver, British Columbia, Canada: British Columbia Office of Health Technology Assessment, Centre for Health Services and Policy Research, University of British Columbia. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Bibby, P., Eikeseth, S., Martin, N. T., Mudford, O. C., & Reeves, D. (2002). Progress and outcomes for children with autism receiving parent-managed intensive interventions. *Research in Developmental Disabilities, 23*(1), 81. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Birnbrauer, J. S., & Leach, D. J. (1993). The Murdoch Early Intervention Program after 2 years. *Behaviour Change, 10*(2), 63–74. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Blue Cross Blue Shield Technology Evaluation Center. (2009). Special report: Early intensive behavioral intervention based on applied behavior analysis among children with autism spectrum disorders. *Assessment Program, 23*(9). The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Buch, G. A. (1996). Teaching parents and paraprofessionals how to provide behavioral intensive early intervention for children with autism and pervasive developmental disorder (Doctoral dissertation, University of California–Los Angeles). *Dissertation Abstracts International*, *56*(9-B), 5153. The study does not meet WWC evidence standards because it does not have at least three attempts to demonstrate an intervention effect at three different points in time.

Chasson, G. S., Harris, G. E., & Neely, W. J. (2007). Cost comparison of early intensive behavioral intervention and special education for children with autism. *Journal of Child and Family Studies, 16*(3), 401–413. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA model in a community setting. *Journal of Developmental & Behavioral Pediatrics, 27*(2), 145–155. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Committee on Educational Interventions for Children with Autism. (2001). *Educating children with autism*. Washington, DC: National Academy Press. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Connor, M. (1998). A review of behavioural early intervention programmes for children with autism. *Educational Psychology in Practice, 14*(2), 109–117. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Connor, M. (2003). Monitoring and reviewing early behavioural intervention in autism (Lovaas). *Educational Psychology in Practice, 19*(1), 21–33. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Eikeseth, S. (2009). Outcome of comprehensive psycho-educational interventions for young children with autism. *Research in Developmental Disabilities, 30*(1), 158–178. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

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Eikeseth, S., Hayward, D., Gale, C., Gitlesen, J., & Eldevik, S. (2009). Intensity of supervision and outcome for preschool aged children receiving early and intensive behavioral interventions: A preliminary study. *Research in Autism Spectrum Disorders, 3*(1), 67–73. The study is ineligible for review because it does not use a comparison group design or a single-case design.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism: A 1-year comparison controlled study. *Behavior Modification, 26*(1), 49. The study is ineligible for review because it does not use a sample aligned with the protocol—the sample is not within the specified age or grade range.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2007). Outcome for children with autism who began intensive behavioral treatment between ages 4 and 7: A comparison controlled study. *Behavior Modification, 31*(3), 264–278. The study is ineligible for review because it does not use a sample aligned with the protocol—the sample is not within the specified age or grade range.

Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low-intensity behavioral treatment for children with autism and mental retardation. *Journal of Autism and Developmental Disorders, 36*(2), 211–224. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2009). Meta-analysis of early intensive behavioral intervention for children with autism. *Journal of Clinical Child & Adolescent Psychology, 38*(3), 439–450. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Farrell, P., Trigonaki, N., & Webster, D. (2005). An exploratory evaluation of two early intervention programmes for young children with autism. *Educational and Child Psychology, 22*(4), 29–40. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Gresham, F. M., Beebe-Frankenberger, M., & MacMillan, D. L. (1999). A selective review of treatments for children with autism: Description and methodological considerations. *School Psychology Review, 28*(4), 559. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Harris, S. L., & Weiss, M. J. (2007). *Right from the start: Behavioral intervention for young children with autism* (2nd ed.). Bethesda, MD: Woodbine House. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Hourmanesh, N. (2006). Early comprehensive interventions for children with autism: A meta-analysis (Doctoral dissertation, University of Utah). *Dissertation Abstracts International*, *67*(07A), 140–2463. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Howlin, P., Magiati, I., & Charman, T. (2009). Systematic review of early intensive behavioral interventions for children with autism. *American Journal on Intellectual and Developmental Disabilities, 114*(1), 23–41. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Hutchison-Harris, J. (2003). Does first year treatment intensity predict outcome in young autistic children receiving *Lovaas ABA* intervention? (Doctoral dissertation, University of Southern California). *Dissertation Abstracts International*, *65*(05B), 156–2609. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

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Jacobson, J. W., & Mulick, J. A. (2000). System and cost research issues in treatments for people with autistic disorders. *Journal of Autism and Developmental Disorders, 30*(6), 585. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Jacobson, J. W., Mulick, J. A., & Green, G. (1998). Cost-benefit estimates for early intensive behavioral intervention for young children with autism—general model and single state case. *Behavioral Interventions, 13*(4), 201–226. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Jones, J. T. (2007). Applied behavior analysis as a treatment for autism: A comprehensive literature review (Doctoral dissertation, Alliant International University, San Diego). *Dissertation Abstracts International*, *68*(07A), 50–2810. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Keesbury, S. A. (1997). *The effectiveness of Lovaas therapy for children with autism*. Unpublished master's thesis, Mankato State University, MN. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Leader, G., Healy, O., & O'Connor, J. Early intensive behavioral intervention in the treatment of autistic spectrum disorders. In P. Reed (Ed.), *Behavioral theories and interventions for autism* (pp. 103–131). New York: Nova Science. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3–9. The study is ineligible for review because it does not occur within the time frame specified in the protocol.

Lovaas, O. I. (1989). A comprehensive behavioral theory of autistic children: Paradigm for research and treatment. *Journal of Behavior Therapy and Experimental Psychiatry, 20*, 17–29. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Lovaas, O. I. (1993). The development of a treatment-research project for developmentally disabled and autistic children. *Journal of Applied Behavior Analysis, 26*(4), 617. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Lovaas, O. I. (1994). Intensive and long-term treatments for clients with destructive behavior. In T. Thompson & D. Gray (Eds.), *Destructive behavior in developmental disabilities: Diagnosis and treatment* (pp. 243–260). Thousand Oaks, CA: Sage Publications. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Lovaas, O. I. (1996). The UCLA young autism model of service. In C. Maurice, G. Green, & S. C. Luce (Eds.), *Behavioral intervention for young children with autism: A manual for parents and professionals* (pp. 241–248). Austin, TX: Pro-Ed, Inc. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Lovaas, O. I., & Buch, G. (1997). Intensive behavioral intervention with young children with autism. In N. H. Singh (Ed.), *Prevention and treatment of severe behavior problems* (pp. 61–86). Belmont, CA: Brooks/Cole Publishing Co. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Lovaas, O. I., & Smith, T. (2003). Early and intensive behavioral intervention in autism. In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 325–340). New York: Guilford Press. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

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Ludwig, S., & Harstall, H. (2001). *Intensive intervention programs for children with autism*. Edmonton, Alberta, Canada: Alberta Heritage Foundation for Medical Research. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Luiselli, J. K., Cannon, B. O., Ellis, J. T., & Sisson, R. W. (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder: A preliminary evaluation of outcome in relation to child age and intensity of service delivery. *Autism, 4*(4), 426–438. The study is ineligible for review because it does not use a comparison group design or a single-case design.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97*(4), 359–372. The study is ineligible for review because it does not occur within the time frame specified in the protocol.

Mudford, O. C., Martin, N. T., Eikeseth, S., & Bibby, P. (2001). Parent-managed behavioral treatment for preschool children with autism: Some characteristics of UK programs. *Research in Developmental Disabilities, 22*(3), 173–182. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Perry, R., Cohen, I., & DeCarlo, R. (1995). Case study: Deterioration, autism, and recovery in two siblings. *Journal of the American Academy of Child & Adolescent Psychiatry, 34*(2), 232–237. The study is ineligible for review because it does not use a comparison group design or a single-case design.

Reed, P., Osborne, L. A., & Corness, M. (2007). Brief report: Relative effectiveness of different home-based behavioral approaches to early teaching intervention. *Journal of Autism and Developmental Disorders, 37*(9), 1815–1821. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Reed, P., Osborne, L. A., & Corness, M. (2007). The real-world effectiveness of early teaching interventions for children with autism spectrum disorder. *Exceptional Children, 73*(4), 417–433. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Reichow, B., & Wolery, M. (2009). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the UCLA Young Autism Project model. *Journal of Autism and Developmental Disorders, 39*(1), 23–41. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Rogers, S. J., & Vismara, L. A. (2008). Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child & Adolescent Psychology, 37*(1), 8–38. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Shea, V. (2004). A perspective on the research literature related to early intensive behavioral intervention (*Lovaas*) for young children with autism. *Autism: The International Journal of Research & Practice, 8*(4), 349–367. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Sheinkopf, S. J., & Siegel, B. (1998). Home based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders, 28*(1), 15–23. The study does not meet WWC evidence standards because it only includes outcomes that are overaligned with the intervention or measured in a way that is inconsistent with the protocol.

Smith, T., Buch, G. A., & Gamby, T. E. (2000). Parent-directed, intensive early intervention for children with pervasive developmental disorder. *Research in Developmental Disabilities, 21*(4), 297–309. The study does not meet WWC evidence standards because it does not have at least three attempts to demonstrate an intervention effect at three different points in time.

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Smith, T., Donahoe, P. A., & Davis, B. J. (2000). The UCLA Young Autism Project. In S. Harris & J. Handelman (Eds.), *Preschool education programs for children with autism* (2nd ed.; pp. 29–48). Austin, TX: Pro-Ed, Inc. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Smith, T., Eikeseth, S., Klevstrand, M., & Lovaas, O. I. (1997). Intensive behavioral treatment for preschoolers with severe mental retardation and pervasive developmental disorder. *American Journal on Mental Retardation, 102*(3), 238–249. The study does not meet WWC evidence standards because the measures of effectiveness cannot be attributed solely to the intervention—the intervention was combined with another intervention.

Smith, T., Klevstrand, M., & Lovaas, O. I. (1995). Behavioral treatment of Rett's disorder: Ineffectiveness in three cases. *American Journal on Mental Retardation, 100*(3), 317–322. The study is ineligible for review because it does not use a comparison group design or a single-case design.

Smith, T., & Lovaas, O. I. (1998). Intensive and early behavioral intervention with autism: The UCLA Young Autism Project. *Infants and Young Children, 10*(3), 67–78. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Smith, T., Mruzek, D. W., & Peyton, R. T. (2008). A study in perseverance: The emergence of early intensive behavioral intervention. In E. Cippani (Ed.), *Triumphs in early autism treatment* (pp. 151–170). New York: Springer. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Smith, T. A. (2004). *The long term effects of the* Lovaas *approach on the development of autistic children*. Unpublished dissertation, St. Cloud State University, MS. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

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. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Tews, L. (2007). Early intervention for children with autism: Methodologies critique. *Developmental Disabilities Bulletin, 35*(1–2), 148–168. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention, such as a meta-analysis or research literature review.

Appendix

Appendix A1.1 Study characteristics: Sallows & Graupner, 2005

Characteristic	Description
Study citation	Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation, 110*(6), 417–438.
Participants	Children were recruited for the study through local birth to age 3 special education programs. Eligible children were (1) age 24 to 42 months at intake, (2) had a mental age divided by chronological age of the Mental Development Index equal to or greater than 35, (3) neurologically within "normal" limits, and (4) diagnosed with autism by an independent child psychiatrist. The parents of all eligible children agreed to participate. Thirteen children entered the study in 1996 and 11 in 1997. Twenty-four children were matched on pretest measures of IQ and randomly assigned to the treatment or comparison condition. One child dropped out of the study,[1] resulting in an analytic sample of 23 children (13 in the treatment group and 10 in the comparison group).
Setting	Madison, Wisconsin
Intervention	The program was based on the UCLA *Lovaas Model*, which initially focuses on one-on-one discrete trials and progresses from simpler to more complex skills. The therapist would engage the child in favorite activities, providing brief task instruction, such as "sit down" or making a request. Reinforcements, such as edibles or physical play, were given after each trial; in between, children were encouraged to generalize the lessons into more natural settings and develop social responsiveness. The program was intended to be 40 hours a week of direct treatment, although the averages for years 1 and 2 were 39 and 37 hours a week, respectively. The hours of treatment declined in subsequent years as the children began school. Children received 6 to 10 hours per week of in-home supervision from a senior therapist and weekly consultations with the senior author or clinic supervisor, during which the senior author/clinic supervisor observed the child and recommended appropriate changes to the program.
Comparison	Children in the comparison group received a parent-directed intervention consistent with the UCLA *Lovaas Model*. The parents in this group selected how many weekly treatment hours their children received from the therapist, averaging 32 hours in year 1 and 31 hours in year 2, with the exception of one family that chose to have 14 hours of treatment. The children received 6 hours per month of in-home supervision from a senior therapist and consultations every two months with the senior author or clinic supervisor, during which the senior author/clinic supervisor observed the child and recommended appropriate changes to the program.
Primary outcomes and measurement[2]	Communication/language competencies, social-emotional development and behavior, and functional abilities were assessed with the Vineland Adaptive Behavior Scales and the Autism Diagnostic Interview–Revised. Functional abilities also were assessed with the Vineland Adaptive Behavior Scales. For a more detailed description of these outcome measures, see Appendices A2.2–A2.4.
Staff/teacher training	Therapists had completed at least one year of college and attended 30 hours of training, at least 10 of which were one-on-one training and feedback while working with their assigned child. Therapists attended weekly or biweekly team meetings. Senior therapists had a minimum of a four-year degree, one year of experience as a therapist with two or more children, and a 16-week internship at the UCLA facility.

1. The study does not report the child's treatment condition.
2. Sallows and Graupner (2005) reported additional outcomes on IQ and language not included in this report. These outcomes combined different measures and were excluded because they did not meet the topic area's requirements for combined outcome measures, as outlined in the protocol. A composite measure of the Vineland Adaptive Behavior Scales also was not reported because the measure included results from different domains. The separate subtests are included in the report.

Appendix A1.2 Study Characteristics: Smith, Groen, & Wynn, 2000

Characteristic	Description
Study citation	Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105*(4), 269–285.
Participants	For this study, all referrals to the ULCA Young Autism Project were eligible if the following criteria were met: (1) referred to the treatment center between 1989 and 1992, (2) chronological age between 18 and 42 months, (3) residence within a one-hour drive of treatment center, (4) IQ ratio between 35 and 75, (5) diagnosis of autism or pervasive developmental disorder not otherwise specified, and (6) no other major medical problems. Of those determined to meet the criteria, one family declined, and eight others were determined not to be eligible. Children were divided into two strata: those with autism and those with other diagnoses. Within the strata, 32 children were divided into pairs based on IQ and randomly assigned to the treatment or comparison condition. After random assignment, four children with mental retardation and no pervasive developmental disorder were excluded. The final sample included 28 children (15 in the intervention group and 13 in the comparison group).
Setting	Participants resided within a one-hour drive to the research site, located at the University of California–Los Angeles (UCLA) Young Autism Project.
Intervention	The intervention for the treatment group was based on Lovaas's behavior treatment model. The program was implemented with four to six student therapists, supervised by the study authors. Treatment occurred in the children's homes for approximately 30 hours a week for two to three years. Participants' primary caregivers were asked to conduct five hours per week of treatment alongside a student therapist for the first three months of treatment. In the beginning of the treatment, student therapists largely used one-to-one discrete trials, which involve a cue for behavior, guidance on the appropriate response, and reinforcement. As children mastered skills, the treatment progressed from simple tasks to more complex skills. Once the children entered school, student therapists served as aides to help the children adjust to classrooms, and the one-to-one treatment decreased as children progressed.
Comparison	Parents of children in the comparison group received training to use treatment approaches described in the Lovaas et al. (1981)[1] manual. Parents received in-home training in two weekly sessions, totaling five hours per week, for three to nine months. The first author of the study met with parents at the first and last training sessions, and every three months in between. In the first session, parents were asked to identify three goals for the child, and the first author and parent trainer created a plan using the Lovaas approach to reach those goals. In subsequent sessions, the trainer would demonstrate the techniques, observe the parent, and provide feedback.
Primary outcomes and measurement[2]	Cognitive development was assessed with a measure of intellectual functioning, or IQ. For a more detailed description of this outcome measure, see Appendix A2.1.
Staff/teacher training	Training for student therapists for the intervention group was not explicitly stated. Trainers for the comparison group had a minimum of one year of experience at the UCLA Young Autism Project, which included at least six months instructing novice therapists. The trainers for the comparison group received one hour per week of individual supervision from the first author, with additional supervision as needed. The study authors had a combined experience of 10 years at the UCLA Young Autism Project under Lovaas's supervision.

1. Lovaas, O. I., Ackerman, A. B., Alexander, D., Firestone, P., Perkins, J., & Young, D. (1981). *Teaching developmentally disabled children: The ME book*. Austin, TX: Pro-Ed, Inc.
2. Smith et al. (2000) reported additional outcomes not included in this report. These outcomes were excluded because they did not meet the WWC requirements for baseline equivalence (that is, within 0.25 standard deviations at baseline) or required a statistical adjustment, which was not included by the authors.

Appendix A2.1 Outcome measures for the cognitive development domain

Outcome measure	Description
IQ	In the Smith et al. (2000) study, the Stanford-Binet Intelligence Scale was administered to all children. If a basal could not be established, children were given the Bayley Scales of Infant Development–Mental Development Index, which is appropriate for children with developmental levels of 0 to 30 months. The Bayley was scored as a ratio IQ and the Stanford-Binet as a deviation IQ (Smith et al., 2000). At baseline, no children established a basal on the Stanford-Binet. At follow-up, four children in the treatment group and five in the comparison group did not establish a basal on the Stanford-Binet.

Appendix A2.2 Outcome measures for the communication/language competencies domain

Outcome measure	Description
Vineland: Communication subscale	A subscale of the Vineland Adaptive Behavior Scales, which has psychometric data for preschool age children (Sallows & Graupner, 2005). No other information is provided.
Autism Diagnostic Interview–Revised: Communication subscale	Subscale of the Autism Diagnostic Interview–Revised. No other information is provided.

Appendix A2.3 Outcome measures for the social-emotional development and behavior domain

Outcome measure	Description
Vineland: Social Skills subscale	A subscale of the Vineland Adaptive Behavior Scales, which has psychometric data for preschool age children (Sallows & Graupner, 2005). No other information is provided.
Autism Diagnostic Interview–Revised: Social Skills subscale	Subscale of the Autism Diagnostic Interview–Revised. No other information is provided.
Autism Diagnostic Interview–Revised: Ritual subscale	Subscale of the Autism Diagnostic Interview–Revised. No other information is provided.

Appendix A2.4 Outcome measures for the functional abilities domain

Outcome measure	Description
Vineland: Daily Living Skills subscale	A subscale of the Vineland Adaptive Behavior Scales, which has psychometric data for preschool age children (Sallows & Graupner, 2005). No other information is provided.

Appendix A3.1 Summary of study findings included in the rating for the cognitive development domain[1]

Outcome measure	Study sample	Sample size (children)	Authors' findings from the study: Mean outcome (standard deviation)[2] — *Lovaas Model* group	Authors' findings from the study: Mean outcome (standard deviation)[2] — Comparison group	WWC calculations: Mean difference[3] (*Lovaas Model* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Smith, Groen, & Wynn, 2000[7]								
IQ	Full sample	28	66.65 (24.08)	49.67 (19.74)	16.98	+0.74	ns	+27
Domain average for cognitive development[8]						**+0.74**	**na**	**+27**

ns = not statistically significant
na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the cognitive development domain.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Smith, Groen, and Wynn (2000), the treatment mean is the sum of the comparison mean and the adjusted mean difference, which accounts for pretest differences.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Smith, Groen, and Wynn (2000), no corrections for clustering or multiple comparisons were needed. However, the authors used a one-tailed test, whereas the WWC uses two-tailed tests, so the significance levels may differ from those reported in the original study.
8. This row provides the study average, which in this instance is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

Appendix A3.2 Summary of study findings included in the rating for the communication/language competencies domain[1]

Outcome measure	Study sample	Sample size (children)	Authors' findings from the study: Mean outcome (standard deviation)[2] — *Lovaas Model* group	Authors' findings from the study: Mean outcome (standard deviation)[2] — Comparison group	WWC calculations: Mean difference[3] (*Lovaas Model* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Sallows & Graupner, 2005[7]								
Vineland: Communication	Full sample	23	79.43 (32.32)	81.40 (24.33)	–1.97	–0.07	ns	–3
ADI-R: Communication	Full sample	23	8.13 (6.91)	8.80 (7.43)	–0.67	–0.09	ns	–4
Domain average for communication/language competencies[8]						**–0.08**	**na**	**–3**

ADI-R = Autism Diagnostic Interview–Revised
ns = not statistically significant
na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the communication/language competencies domain.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Sallows and Graupner (2005), the treatment mean is the sum of the comparison mean and the adjusted mean difference, which accounts for pretest differences.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Sallows and Graupner (2005), no corrections for clustering or multiple comparisons were needed; the latter because no impacts were statistically significant.
8. This row provides the study average, which in this instance is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

Appendix A3.3 Summary of study findings included in the rating for the social-emotional development/behavior domain[1]

Outcome measure	Study sample	Sample size (children)	Authors' findings from the study: Mean outcome (standard deviation)[2] — *Lovaas Model* group	Authors' findings from the study: Mean outcome (standard deviation)[2] — Comparison group	WWC calculations: Mean difference[3] (*Lovaas Model* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Sallows & Graupner, 2005[7]								
Vineland: Social Skills	Full sample	23	75.84 (23.49)	68.90 (10.11)	6.94	0.35	ns	+14
ADI-R: Social Skills	Full sample	23	13.69 (10.58)	13.10 (9.42)	0.59	0.06	ns	+2
ADI-R: Ritual	Full sample	23	6.10 (3.75)	5.60 (3.50)	0.50	0.13	ns	+5
Domain average for social-emotional development/behavior[8]						**0.18**	**na**	**+7**

ADI-R = Autism Diagnostic Interview–Revised
ns = not statistically significant
na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the social-emotional development/behavior domain.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Sallows and Graupner (2005), the treatment mean is the sum of the comparison mean and the adjusted mean difference, which accounts for pretest differences.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Sallows and Graupner (2005), no corrections for clustering or multiple comparisons were needed; the latter because no impacts were statistically significant.
8. This row provides the study average, which in this instance is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

Appendix A3.4 Summary of study findings included in the rating for the functional abilities domain[1]

Outcome measure	Study sample	Sample size (children)	Authors' findings from the study: Mean outcome (standard deviation)[2] — *Lovaas Model* group	Authors' findings from the study: Mean outcome (standard deviation)[2] — Comparison group	WWC calculations: Mean difference[3] (*Lovaas Model* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Sallows & Graupner, 2005								
Vineland: Daily Living Skills	Full sample	23	66.51 (25.95)	64.20 (12.42)	2.31	0.10	ns	+4
Domain average for functional abilities[8]						**0.10**	**na**	**+4**

ns = not statistically significant

na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the functional abilities domain.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Sallows and Graupner (2005), the treatment mean is the sum of the comparison mean and the adjusted mean difference, which accounts for pretest differences.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Sallows and Graupner (2005), no corrections for clustering or multiple comparisons were needed.
8. This row provides the study average, which in this instance is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

Appendix A4.1 *Lovaas Model* rating for the cognitive development domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of cognitive development, the WWC rated the *Lovaas Model* as having potentially positive effects for preschool children with disabilities. The remaining ratings (mixed effects, no discernible effects, potentially negative effects, negative effects) were not considered, as the *Lovaas Model* was assigned the highest applicable rating.

Rating received

Potentially positive effects: Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

  Met. The one study that met WWC evidence standards with reservations showed a substantively important positive effect.

AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

  Met. No studies showed a statistically significant or substantively important negative effect.

Other ratings considered

Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. Only one study met WWC evidence standards with reservations.

AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

  Met. The one study that met WWC evidence standards with reservations did not show statistically significant or substantively important negative effects.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Procedures and Standards Handbook, Appendix E.

Appendix A4.2 *Lovaas Model* rating for the communication/language competencies domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of communication/language competencies, the WWC rated the *Lovaas Model* as having no discernible effects for children with disabilities.

Rating received

No discernible effects: No affirmative evidence of effects.

- Criterion 1: No studies showing a statistically significant or substantively important effect, either *positive* or *negative*.

  Met. The one study that measured communication/language competencies did not show a statistically significant or substantively important effect.

Other ratings considered

Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed statistically significant positive effects.

AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

  Met. No studies showed statistically significant or substantively important negative effects.

Potentially positive effects: Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important positive effect.

AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

  Met. No studies showed a statistically significant or substantively important negative effect.

Mixed effects: Evidence of inconsistent effects as demonstrated through either of the following criteria.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important positive effect.

OR

- Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.

  Not met. No studies showed a statistically significant or substantively important effect.

(continued)

Appendix A4.2 *Lovaas Model* rating for the communication/language competencies domain *(continued)*

Potentially negative effects: Evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: One study showing a statistically significant or substantively important *negative* effect and no studies showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important negative effect.

OR

- Criterion 2: Two or more studies showing statistically significant or substantively important *negative* effects, at least one study showing a statistically significant or substantively important *positive* effect, and more studies showing statistically significant or substantively important *negative* effects than showing statistically significant or substantively important *positive* effects.

  Not met. No studies showed a statistically significant or substantively important positive effect.

Negative effects: Strong evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *negative* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed a statistically significant negative effect.

AND

- Criterion 2: No studies showing statistically significant or substantively important *positive* effects.

  Met. No studies showed a statistically significant positive effect.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Procedures and Standards Handbook, Appendix E.

Appendix A4.3 *Lovaas Model* rating for the social-emotional development/behavior domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of social-emotional development/behavior, the WWC rated the *Lovaas Model* as having no discernible effects for children with disabilities.

Rating received

No discernible effects: No affirmative evidence of effects.

- Criterion 1: No studies showing a statistically significant or substantively important effect, either *positive* or *negative*.

  Met. The one study that measured social-emotional development/behavior did not show a statistically significant or substantively important effect.

Other ratings considered

Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed statistically significant positive effects.

AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

  Met. No studies showed statistically significant or substantively important negative effects.

Potentially positive effects: Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important positive effect.

AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

  Met. No studies showed a statistically significant or substantively important negative effect.

Mixed effects: Evidence of inconsistent effects as demonstrated through either of the following criteria.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important positive effect.

OR

- Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.

  Not met. No studies showed a statistically significant or substantively important effect.

(continued)

Appendix A4.3 *Lovaas Model* rating for the social-emotional development/behavior domain *(continued)*

Potentially negative effects: Evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: One study showing a statistically significant or substantively important *negative* effect and no studies showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important negative effect.

OR

- Criterion 2: Two or more studies showing statistically significant or substantively important *negative* effects, at least one study showing a statistically significant or substantively important *positive* effect, and more studies showing statistically significant or substantively important *negative* effects than showing statistically significant or substantively important *positive* effects.

  Not met. No studies showed a statistically significant or substantively important positive effect.

Negative effects: Strong evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *negative* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed a statistically significant negative effect.

AND

- Criterion 2: No studies showing statistically significant or substantively important *positive* effects.

  Met. No studies showed a statistically significant positive effect.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Procedures and Standards Handbook, Appendix E.

Appendix A4.4 *Lovaas Model* rating for the functional abilities domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of functional abilities, the WWC rated *Lovaas Model* as having no discernible effects for children with disabilities.

Rating received
No discernible effects: No affirmative evidence of effects.
• Criterion 1: No studies showing a statistically significant or substantively important effect, either *positive* or *negative*.
Met. The one study that measured functional abilities did not show a statistically significant or substantively important effect.
Other ratings considered
Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.
• Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.
Not met. No studies showed statistically significant positive effects.
AND
• Criterion 2: No studies showing statistically significant or substantively important *negative* effects.
Met. No studies showed statistically significant or substantively important negative effects.
Potentially positive effects: Evidence of a positive effect with no overriding contrary evidence.
• Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.
Not met. No studies showed a statistically significant or substantively important positive effect.
AND
• Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.
Met. No studies showed a statistically significant or substantively important negative effect.
Mixed effects: Evidence of inconsistent effects as demonstrated through either of the following criteria.
• Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.
Not met. Only one study examined functional abilities.
OR
• Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.
Not met. Only one study examined functional abilities, and it did not show a statistically significant or substantively important effect.

(continued)

Appendix A4.4 *Lovaas Model* rating for the functional abilities domain *(continued)*

Potentially negative effects: Evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: One study showing a statistically significant or substantively important *negative* effect and no studies showing a statistically significant or substantively important *positive* effect.

  Not met. No studies showed a statistically significant or substantively important negative effect.

OR

- Criterion 2: Two or more studies showing statistically significant or substantively important *negative* effects, at least one study showing a statistically significant or substantively important *positive* effect, and more studies showing statistically significant or substantively important *negative* effects than showing statistically significant or substantively important *positive* effects.

  Not met. No studies showed a statistically significant or substantively important positive effect.

Negative effects: Strong evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *negative* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed a statistically significant negative effect.

AND

- Criterion 2: No studies showing statistically significant or substantively important *positive* effects.

  Met. No studies showed statistically significant or substantively important positive effects.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Procedures and Standards Handbook, Appendix E.

Appendix A5 Extent of evidence by domain

Outcome domain	Number of studies	Sample size		Extent of evidence[1]
		Centers	Children	
Cognitive development	1	1	28	Small
Communication/language competencies	1	1	23	Small
Literacy	0	na	na	na
Math competencies	0	na	na	na
Social-emotional development/behavior	1	1	23	Small
Functional abilities	1	1	23	Small
Physical well-being	0	na	na	na

na = not applicable/not studied

1. A rating of "medium to large" requires at least two studies and two schools across studies in one domain and a total sample size across studies of at least 350 students or 14 classrooms. Otherwise, the rating is "small." For more details on the extent of evidence categorization, see the WWC Procedures and Standards Handbook, Appendix G.