Original Article

Teaching strategies for children with autism

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Abstract:
The main purpose of this study is the review of literature of five educational interventions for children with autism: Applied Behavior Analysis (ABA), Treatment and Education for Autistic and Related Communication Handicapped Children (TEACCH), preschool program, Learning Experiences, an Alternative Program (LEAP), Denver Health Sciences Centre Program (DHSCP), Early Start Denver Model (ESDM). Potentially relevant articles, reported between 1971 till 2014 were found via computer-aided literature searches. This selection results in 51 articles that were analyzed completely. This study reviewed five treatment programs ABA, TEACCH, LEAP, ESDM, and DHSCP and most of the studies revealed positive results in language, adaptive, cognitive and educational outcomes. Although they showed positive results in many studies and all of these studies have proven effective in many settings, there needs to be more research. The ABA study yielded the most significant results with the strongest methodology with the majority of studies. This review of the literature it has proven that there is no cure for autism, nor is there a single correct approach for all children with autism. A combination of all these studies would definitely bring positive results.
Key words: Autism, ABA, TEACCH, LEAP, DHSCP, ESDM

Introduction

Autism Spectrum Disorder (ASD) is a life-long neurodevelopmental disorder characterized by impairments in social interaction, verbal, and non-verbal communication, and a restricted repertoire of activities and interests (American Psychiatric Association, 2000). In 2013, the American Psychiatric Association published the fifth version of the DSM (DSM-5). This edition consolidated the three distinct ASD conditions from the DSM-IV-TR (autistic disorder, Pervasive Developmental Disorder: not otherwise specified (PDD-NOS), and Asperger disorder) into one condition (autism spectrum disorder) that no longer has subtypes. Individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder. Individuals who have marked deficits in social communication, but whose symptoms do not otherwise meet criteria for autism spectrum disorder, should be evaluated for social (pragmatic) communication disorder (American Psychiatric Association, 2013).

Recently (March 30, 2012), data from the Autism and Developmental Disability Monitoring Network Surveillance (ADDM), reported by the Centers of Disease Control and Prevention (CDC), indicated a significant increase in prevalence of Autism Spectrum Disorder (ASD) (ADDM, 2014). The ADDM Network ASD case definition has been based on the DSM-IV-TR diagnostic criteria since the initial (2000) surveillance year. For 2010, the overall prevalence of ASD among the ADDM sites was 14.7 per 1,000 (one in 68) children aged 8 years. This estimate varied widely across all sites, from 5.7 to 21.9 per 1,000 children aged 8 years. There were wide variations by gender and racial/ethnic groups. Approximately one in 42 boys and one in 189 girls living in the ADDM Network communities were identified as having ASD (ADDM, 2014).

Material
Search Strategy
Potentially relevant articles, reported between 1971 till 2014 were found via computer-aided literature searches. The keywords used for the electronic searches were 'teaching strategies' and 'autism', 'educational interventions' and 'autism', 'ABA' and 'autism', 'TEACCH' and 'autism', 'LEAP' and 'autism', 'The Denver Health Sciences Centre Program' and 'autism', and 'Early Early Start Denver Model' and 'autism'. The following indexing systems were searched: PsycINFO, ERIC, Health Medicine, Sport Discus, Scopus and Web of Science.
Study selection
After locating a series of studies, on the basis of article titles and abstracts, each study to be included in this review had to meet a set of priory criteria regarding relevance to the purpose of this paper. The following six

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eligibility criteria were selected: a) must be original study published from 1971 till 2014 b) must be published in the English language; c) Must be located in periodical publications (i.e., studies located in books, unpublished papers [e.g., doctoral dissertations, master thesis], conference proceedings, or in book chapters were excluded); d) must be mainly focused on children (9 months-22 years old) (e) must provide a clear definition of the sample selected, the assessment instruments employed, and the data analyzes used; f) must include of at least one student who was clinically diagnosed with autism. To determine reliability of the coding progress, I assessed all selected studies according to the 6 eligibility criteria.

Table 1. Applied Behavior Analysis (ABA) empirical studies

Author & Year	Sample	Age	Instruments	Intervention	Findings
1) Lovaas (1987) 2) McEachin et al. (1993)	19 children with autism	32 months	Bayley; CIIS; SB Intelligence scale; VSNS; Videotaped recording; Parent interview	UCLA	47% of experimental group in regular school; 30 point difference on IQ tests; similar differences in adaptive behaviour, maladaptive behaviour and clinical cut off on personality inventory
3) Birnbrauer, & Leach (1993)	9 children (5 boys) with autism	39 months	Assessment battery; Intellectual functioning; VABS; PSI; PIC; BO	UCLA	No group analysis; 4/9 treated children had nonverbal IQs of 89 or higher; language level of treated group (M=46 months) double that of controls.
4) Sheinkopf & Siegel (1998)	11 children with autism.	33 months	Observations Interviews	UCLA	Treated group mean IQ 25 point's higher than control; Reduced severity; no group differences on number of symptoms.
5) Anderson et al. (1987)	14 children (3girls) with autism.	43 months	ONRTS;BOM; Educational placement settings	UCLA	Significant increase in mental age on all measures; Increased developmental rates; Significant increases in parent teaching skills.
6) Harris et al. (1990)	10 children with autism.	Segregated class: 58 months Integrated: 55.8	PLS	UCLA	All of the children progress in rate of language development; Lower scores of the autistic children than the peers before and after.
7) Harris et al. (1991)	16 children with autism.	46.63 months	SB: FE; PLS	UCLA	Children with autism: increase of 19-point in IQ and an increase of 8-point in language functioning; Normal peers: 7.73-point increase in language while the IQ remained stable.
8) Fenske et al. (1985)	18 children with autism (16 boys-1 girl)	1st group: 48.9 months; 2nd: 101.2 months	PPVT	ABA	67 % of younger group positive outcomes vs. 11% of older group; 4 attended public schools of the younger and 2 special education and of the older group only 1 regular class.
9) Harris & Handleman (2000)	27 children with autism	49 months	DDDC	ABA	Having a higher IQ at intake and being of younger age were both predictive of being in a regular education class after discharge.
10) Dillenburger et al. (2004)	22 families	3-12/13 years	Questionnaires	ABA	Long-term group: complex goals with their children; Short term group: positive impact on child and family functioning and parental self-esteem.
11) Grey et al. (2005)	9 boys & 3 girls with autism.	2 years10 months- 15 years	TCFT; Interview & Questionnaires of parents and teachers	ABA	8o percent change in frequency of occurrence of target behaviour.
12) Wong et al. (2007)	41 children with autism	31-55 months	MSEL; NRDLS; Structured Play; ESCS; Mother Child Interaction Assessments.	ABA .	Mastery and generalization of joint attention and symbolic play skills; children with higher mental and language ages reached performance mastery criteria faster than children with lower scores.
13) Eikeseth et al. (2009)	23 children (6 girls) with autism	34.9 months	WPPSI-R; Merrill-Palmer Scale of Mental Tests, NRDLS; VABS	ABA	Mean intake IQ: 54.2; Follow up: 70.7; Mean intake visual-spatial IQ: 76.1; Follow up: 82.8; Mean intensity of supervision 2.9 to 7.8 h per month.
14) Fernell et al. (2011)	208 children with autism	20-54 months	VABS; ABC; DISCO-10; IQ-DQ-test ANOVA	ABA	Children with autism with normal cognitive functioning: improved their levels of adaptive functioning; The intensity was not associated with adaptive functioning outcome in any of the cognitive subgroups; Younger age at start of intervention was not associated positively

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with outcome.

15) McPhilemy et al. (2013)	17 children (15 boys and 2 girls) with autism.	24 months-20 years old	Questionnaires for parents	ABA	Positive impact in areas such as: social skills , challenging behavior, communication, gross and fine motor skills, concentration, interaction, independence, positive impact on their overall quality of life and a feeling of hope for future.
16) Grindle et al. (2012)	11 children (9 boys and 2 girls) with autism.	43 and 68 months	SB-FE; Leiter-R; Bayley-II; VABS; ABLLS	ABA	After one year of intervention: moderate and large effects for IQ and adaptive behavior; After 2 years of intervention: continued to learn new skills but IQ had a small size effect.
17) Eikeseth et al. (2012)	35 children (6 girls) with autism.	3 years and 11 months	VABS; CARS	ABA	First year of EIBI: significant improvements in adaptive and maladaptive behaviors; After one year EIBI: improvements in adaptive and maladaptive behaviors but in a lesser degree.
18) Rivard et al. (2014)	93 (70 boys and 23 girls) children with	46 months	CARS; WPPSI-III ABAS-II; SCBE	ABA	After 12 months of EBI: children improvements in intellectual functioning, adaptive behaviour and socioaffective competencies; Pre-program: positive impact in parent's life.
19) MacDonald et al. (2014)	83 children with autism.	1-, 2-, 3-years-old.	ESAT	ABA	Children aged 18-23 months-old: greatest change across all outcome measures; All age groups increased on: Responding Joint Attention (RJA), Initiation Joint Attention (IJA) play, imitation and language; Decreases

Applied Behavior Analysis (ABA)

Since 1970's the science of ABA has been used to create a program for individuals with autism that target specific skills in a specialized sequence, the goal being to alter behavior so as to increase and / or improve socialization, communication, and general adaptive functioning (Jensen & Sinclair, 2002). The ABA approach teaches social, motor, and verbal behaviors as well as reasoning skills (Harris & Delmolino, 2002). ABA uses careful behavioral observation and positive reinforcement or prompting to each step of a behavior (Simpson, 2001). ABA can include any of several established teaching tools such as (Jensen & Sinclair, 2002): Discrete trial training (DTT); Incidental teaching; Pivotal response training (see table 1 of ABA empirical studies).

Review of ABA empirical studies

The UCLA Young Autism Project (YAP) initiated by Lovaas and his colleagues in 1970 whose goal was to maximize behavioral treatments gains made by children with autism and to stress the importance of parental involvement in therapy (Howlin et al. 2009). The study with the strongest scientific design on the effectiveness of Early Intensive Behavioral Intervention (EIBI) was carried out by Lovaas and his colleagues (1987), reporting that preschool children involved Discrete Trial 1:1 therapy for 40 hours a week or more, over at least 2 years showed significant gains in IQ. 47% of children were described as normal intellectual and educational functioning as they recovered and passed through normal first grade in a public school into a regular classroom. A follow up study by McEachin et al. (1993) confirmed the same gains. Reports of partial replications of the UCLA project have come from three sites: the May centre (Anderson, Avery, Di Pietro, Edwards, and Christian, 1987), Murdoch University (Birnbrauer and Leach, 1993), and Sheincopf and Siegel (1998) but none of these studies had the same results. The Lovaas study (1987) has never been replicated with the same intensity of 40 hours and the studies that followed based to a broader Applied Behavior Analysis interventions.

There is empirical evidence that children with autism receiving Early and Intensive Behavioral Intervention (EIBI) made significant gains on standardized measures of IQ, language, and adaptive behaviors (Hayward, Gale, & Eikeseth, 2009). There is gathering evidence for the positive effects of Early Intensive and non-intensive Behavioral Intervention based on the principles of Applied Behavior Analysis (ABA) for young children with autism (Eikeseth et al., 2009; Eikeseth et al., 2012; Howlin et al., 2009; Mac Donald et al,. 2014; Anderson et al., 1987; Birnbrauer and Leach 1993; Rivard et al., 2014; Fernell et al., 2011). Fernell et al., (2011) supported that the data cannot be taken to support that children with ASD generally benefit from intensive than non-intensive ABA program and there is a need for more research. EIBI is effective when it is both intensive-non intensive and extensive-minimally 2 years (2014) with 25-40 hours and 16-20 hours as the study of Rivard et al., (2014) who revealed significant improvements in terms of intellectual, adaptive functioning and

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socioaffective competencies with an intensity of 16-20 hours. In this study also noted significant improvements in the areas of join attention, symbolic play skills and Dillenburger, 2013; Rivard et al., 2014).

Some of the studies showed significant gains of parental involvement in ABA-based interventions (Grindle et al., 2012; MacDonald et al., 2014; McPhilemy and Dillenburger, 2013; Rivard et al., 2014; Dillenburger et al., 2004; Anderson et al., 1987). The expense of privately home-based ABA interventions was a problem for many parents (McPhilemy and Dillenburger, 2013). The implementation of ABA is of particular relevance to autism as it is the only method of instruction which has shown consistent empirically supported improvements in the core deficits of the disorder (Dempsey & Foreman, 2001).

Notes for instruments of Table 1 of ABA empirical studies

VABS= Vineland Adaptive Behavior Scale; ABLLS= Assessment of Basic Language and Learning Skills; CARS= Childhood Autism Rating Scale; WPPSI-III= Third edition of the Wechsler Preschool and Primary Scale of Intelligence; ABAS-II= Adaptive Behavior Assessment System; SCBE= Social Competence and Behavior Evaluation Scale; ABC= Autistic Behaviour Scales; DISCO-10= Diagnosis of Social and Communication disorder; ESAT= Early Skills Assessment Tool; Bayley-III= Bayley Scales of Infant and Toddler Development, Third Edition; CIIS= Cattell Infant Intelligence Scale; VSNS= Vineland Social Maturity Scale; PSI= Language parenting stress index; PIC= Personality inventory for children; PPVT= Peabody Picture Vocabulary Test; DDDC= Douglas Developmental Disability Centre; MSEL= Mullen Scales of Early Learning; NRDLS= Reynell Developmental Language Scales; ESCS= Early Social Communication Skills; SB-FE=Stanford-Binet Intelligence Scale-Fourth Edition; Leiter-R= Leiter International Performance Scale-Revised; Bayley-II=Bayley Scales of Infant Development-Second Edition; BO= Behavioural observations; SB= Stanford-Binet Intelligence scale; PLS= Preschool Language Scale; TCFT= Training Comprehensive functional treatment; BOM= Behavioural Observation Measures; ONRTS= Objective Norm-Reference Test Scores;

Treatment and Education for Autistic and Related Communication Handicapped Children (TEACCH)

The program was founded by Eric Schopler in the early 1970s at the University of North Carolina at Chapel Hill when the department of psychiatry enlisted the help of parents of children with autism as co therapists for their own children (Schopler & Reichler, 1971).

The focus of TEACCH is on building upon each child's unique strengths and differences to help him/her become successful (Mesibov, 2006). TEACCH uses structured teaching to train children in the areas of social skills, living skills, leisure skills and communication skills (Gresham et al, 1999 ;). So the most key and recognizable feature of TEACCH is structured teaching which includes 4 major components (Mesibov, 2006): a) Organization of the physical environment; b) Predictable sequences of activities; c) Visual schedules; d) Structures systems of work/activity. The cornerstone of the TEACCH program is its emphasis on forming a partnership between the parents of the autistic and the professionals working with the child (Peerenboom, 2003) (see table 2 of TEACCH empirical studies).

Review of TEACCH empirical studies

Researches demonstrate that parental involvement provides a number of benefits for both children with autism and their parents (Welterlin et al., 2012; Ichikawa et al., 2013; D'Elia et al., (2014); Panerai et al., 2009; Ozonoff and Cathcart, 1998; Panerai et al., 2009; Braiden et al., 2012). Many studies assessed cognitive functioning with positive effects (Schopler et al., 1971; Lord & Schopler, 1989; Venter et al., 1992; Ozonoff & Cathcart, 1998; Panerai et al., 1997, 2002; Ichikawa et al., 2013). Studies revealed improvements in the areas of imitation, perception and motor skills (Panerai et al., 1997, 2009; Ozonoff & Cathcart, 1998; Tsang et al., 2006). Most of the studies assessed areas of adaptive behavior and socialization and there were found positive results (Panerai et al., 2002, 2007; Franke & Geist, 2003; Siaperas and Brown, 2006; Hume & Odom, 2007; Mavropoulou et al., 2011; Welterlin et al., 2012; Ichikawa et al., 2013); D'Elia et al., 2014). Also studies reported language gains (Lord & Schopler, 1989; D'Elia et al. 2014; Braiden et al. 2012).

Only recently sufficient numbers of studies have been published following a consistent methodology to allow meta-analysis (Virues-Ortega et al. 2013). Some of these studies have been published latest by Virues-Ortega et al., (2013) and included in the meta-analysis (Leppert & Probst, 2005; Braiden et al., Probst & Leppert, 2008; Siaperas &Beadle-Brown, 2006; Ozonoff & Cathcart, 1998; Panerai et al., 2002, 2009; Tsang et al. 2007; Welterlin et al. 2012). The meta-analysis of Virues-Ortega et al., (2013) suggested that TEACCH effects over perceptual, motor, verbal and cognitive skills may be of small magnitude and effects over adaptive behavioral repertories including communication, and activities of daily living may be within the negligible to small range. Social behavior and maladaptive behavior, and motor functioning showed moderate to large effects. Because of the limited number of appropriately designed studies it was not demonstrated that TEACCH is an effective or ineffective program across children and adults (Virues-Ortega et al. 2013).

Table 2. Treatment and Education for Autistic and Related Communication Handicapped Children (TEACCH) empirical studies

Author & year	Sample	Age	Instruments	Intervention	Findings
1) Schopler et al. (1971)	4 boys, 1 girl with autism	4-8 years	Attention-attending vs. attending; Affect-appropriate vs. inappropriate	TEACCH	Autistics learn more in a structured than an unstructured situation; On a higher developmental level were better able to utilize relative unstructured.
2) Lord & Schopler (1989)	72 children with autism	3 years	Merrill Palmer Scale of Mental health; Leiter; WISC-Performance IQ	TEACCH	3-7 IQ point from ages 3-4 years to age 7-9 years; 44 lowest functioning children make the largest IQ gains (15-24) point; Language gains.
3) Venter et al. (1992)	58 children with autism	14.69 months	VABS; WAIS-R; RPM; PPVT; Schonell Graded Spelling Test; NARA; ADOS	TEACCH	Verbal skills- strongest predictor of social adaptive functioning; positive intellectual functioning, and academic attainment; Early nonverbal IQ- positive relationship with outcome.
4) Panerai et al. (1997)	18 autistic children	16 months	CPEP-R; VABS; Structured observations	TEACCH	Improvement on: Socialization, communication, self-help care, perception, motor activities, cognitive performances; Reductions: stereotypes
5) Ozonoff & Cathcart (1998)	11 children with autism	2-6 years old	CARS; CPEP-R	TEACCH	Improvement on imitation, fine motor, and gross motor skills, and cognitive subtest; 3-4 times higher than control group.
6) Panerai et al. (2002)	8 children with autism	8 years	VABS; CPEP-R	TEACCH	Significant results in: imitation, perception, gross motor skills, hand–eye coordination, cognitive performance, total score and developmental age. Control group: results only hand–eye coordination.
7) Franche & Geist (2003)	1 child with autism	2 years	Observations (video and recordings)	TEACCH	Higher levels of social and play behavior
8) Tsang et al. (2006)	18 children with autism	3-5 years	PEP-R; MPSMT; Hong Kong Based Behavioral Scales	TEACCH	Significantly improvements on perception, fine motor and gross motor subtests.
9) Siaperas & Beadle Brown (2006)	12 children with autism (8 men/4 woman)	21.3 years	VABS; CARS	TEACCH	Significant progress on: independence, social abilities and functional communication.
10) Hume & Odon (2007)	3 children with autism	20 years 6 years 7 years	Observations (video and recordings)	TEACCH	Increase on: task behaviour, number of task behaviours, play materials; Reduction: Teacher prompts.
11) Probst & Leppert (2008)	6 children with severe autism; 3 with moderate autism; 1 with mild autism	10 years old	CCBSQ; CTSR; Implementing Structured Learning Strategies in Everyday School Life Questionnaire.	TEACCH	Significant improvement on the Classroom Child Behavioral Symptom Scale & on the Classroom Teachers' Stress Reaction Scale. 9/10 teachers successfully implemented at least one (M=1.8) structured learning strategy in the class.
12) Panerai et al. (2009)	34 male children with autism and mental retardation	9.66 years 8.66 years 9.09 years	VABS; PER-R; Kruskal- Wallis ANOVA test	TEACCH	Positive results for VABS & PER-R Domains; Children in R-TEACCH and NS- TEACCH are greater than those obtained by the Children in INSP.
13) Mavropoulou et al. (2011)	2 students with Autism (ASD)	Vaggelis: 7 years & 6 months; Yiannis 7 years old.	ABAB design	TEACCH	Significant increase for both students for: on-task behaviour and task completion; Visual structure of the pattern of on-task behaviour: positive findings for one student and questionable for the other.

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14) Braiden et al. (2012)	18 children (17 male/1 female) with autism	3 years, 2 months	PSI; CPEP-III; Demographic Questionnaires	TEACCH	Decrease in parental stress; Significant results in receptive and expressive language scores; High level of satisfaction with the program and with their child's progress.
15) Welterlin et al. (2012)	20 children with autism	2-3 years old	MSEL; SIB-R; PSI (3rd ed.)	TEACCH	Significant increases for: independent functioning, parents' ability to structure the environment, effective prompts and decreases in ineffective prompts; Medium to large effects for developmental and adaptive skills of children as well as for parents stress.
16) Ickikawa et al. (2013)	11 children with High Functioning Autism (HFA)	5-6 years	SDQ; PSI; BDI-III; IRS	TEACCH	Moderate effect sizes for: SDQ: 0.71; PSI= 0.58, BDI-III = 0.40, IRS = 0.69; Effective program for children with high IQ & mothers with low stress.
17) D'Elia & Vale (2014)	30 children with autism	2.0-6.1 years	VABS; MacArthur CDIs ; CBCL; PSI-SF; PEP-3	TEACCH	Significant improvements in the severity of autism, adaptive behavior & language skills; Significant results for Psychopathological comorbidity & parental stress but remained unchanged in the children receiving treatment as usual.

Notes for instruments of Table 2 of TEACCH empirical studies

CARS= Childhood autism rating scale; CPEP-R= Psycho educational Profile-revised scale; WAIS-R= Wechsler Adult Intelligence Scale-Revised; RPM= Ravens Progressive Matrices; PPVT= Peabody Picture Vocabulary Test; ADOS= Autism Diagnostic Observation Schedule; CPEP-R= Psycho educational Profile-revised Scale; MPSMT= Merrill Palmer Scale of Mental Test; PEP-R= Developmental Scale; CCBSQ= Classroom Child Behavioral Symptoms Questionnaire; CTSRQ= Classroom Teachers' Stress Reaction Questionnaire; SDQ= Strengths and Difficulties Questionnaire; PSI= Parenting Stress Index; BDI-III = Beck Depression Inventory; IRS= Interaction Rating Scale; Kruskal-Wallis; CPEP-III= Phycho Educational Profile-3; MSEL= Mullen Scales of Early Learning; SIB-R= Scales of Independent Behavior-Revised; PSI) (3rd ed.)= Parenting Stress Index-3rd edition; MacArthur (CDIs) = MacArthur Communication Developmental Inventories; CBCL= Child Behavior Checklist; PSI-SF= Parenting Stress Index-Shot Form.

Learning Experiences Alternative Program (LEAP)

The preschool program, Learning Experiences, an Alternative Program (LEAP) for preschoolers and their parents began in 1982 as a federally funded model demonstration program serving young children with autism and typical children ages 3-5 years within an integrated preschool classroom (Strain & Cordisco, 1994) (see table 3 of LEAP empirical studies).

Review of LEAP empirical studies

LEAP can offer a highly effective, manualized, inclusive, developmentally appropriate, and less costly means of service as LEAP's costs are estimated at US\$ 20,000 per child per year versus between US\$ 45,575 and US\$ 69,050 for ABA, TEACCH (Strain & Bovey, 2011).

Summarized results are as follow: a) Children in LEAP showed significant results in autistic symptoms (Strain & Hoyson, 2000; Strain & Bovey, 2011;) b) Children in LEAP revealed significant improvements in the field of behavioral, development and language measures (Hoyson et al., 1984; Strain et al., 1985; Strain & Bovey, 2011;Strain and Hoyson, 2000). c) Children in LEAP showed improvements in social skills (Odom & Strain, 1986; Strain & Bovey 2011; Strain & Hoyson, 2000).

The overall efficacy of enrolment in LEAP could not be argued without a randomized trial. The results of this RCT study of Stain & Bovey (2011) revealed that: 1) Intervention classes reached a very high level (mean level of 87%) of fidelity; 2) Intervention classes made progress in the fields of cognitive, language, autism symptoms, problem behavior, and social skills; 3) There were found significant correlations between fidelity scores and comparison classes; 4) Primary teachers in intervention classes rated their experience implementing LEAP practices very high; 5) Behavior at entry did not predict outcome nor did family socioeconomic status. An intervention of 17 hr on average per week with a level of intensity 50% to 60% less than offered other Randomized Controlled Trials confirm its efficacy of LEAP in producing behavioral change (Strain & Bovey, 2011).

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Table 3. Learning Experiences Alternative Program (LEAP) empirical studies

Author & Year	Sample	Age	Instruments	Intervention	Findings
1) Strain et al. (1985)	6 children with autism	42 months	Observational data	LEAP	Autistic children: positive peer interactions; The LEAP normally developing children: less disruptive behavior and equal amounts of on-task, appropriate language, and positive peer interaction.
2) Odom & Strain (1986)	3 children with autism	4 years	Observational system; Peer confederate questionnaire; IOA	LEAP	Peer initiation increase: social responses, provided verbal prompts; Teacher antecedent increase: initiations and responses provided physical and verbal prompts.
3) Hoyson (1984)	6 children with autism	30 – 53 months	LAP	LEAP	Rate of development twofold increased for: normally developing and autistic children; Rate of performance of autistic children above that of normally developing children.
4) Strain & Bovey (2011)	177 children with autism	50.1 months	QPI; CARS; MSEL (4th ed.; PLS-4); SSRS; Social Validity Measure	LEAP	Intervention group: significant improvements in cognitive, language, autism symptoms, problem behavior, and social skills, very high level of fidelity (mean of 87%) of implementation; Teachers' experiences: very favourable ratings; The correlation between social validity and fidelity scores were significant.
5) Strain & Hoyson (2000)	6 children with autism	30-35 months	CARS; LAP; SB; Direct Observation of Appropriate Behavior; Direct Observation of Social Interaction; Interviews	LEAP	Significant gains in severity of autism; No more characterized as autistics; Gains in the field of developmental functioning; Significant behavioral improvement after leaving LEAP: 5 of the six children continued in regular class.

Notes for instruments of table 3 of Learning Experiences Alternative Program (LEAP)

IOA= Interobserver Agreement; QPI= Quality Program Indicators; CARS= Child Autism Rating Scale; MSEL (4th ed.; PLS-4) = Mullen Scales of Early Learning Preschool Language Scale (4th ed.; PLS-4); SSRS= Social Skills Rating System; LAP= Learning Accomplishment Profile; SBIQ= Stanford Binet IQ Scale; LAP= Learning accomplishment profile; SB= Stanford Binet.

Denver Health Sciences Centre Program (DHSCP)

The Denver Health Sciences Centre Program (DHSCP) was initiated in 1981 at the University of Colorado by Rogers and colleagues (Rogers, 1998). This program focuses on use of play, interpersonal relationships, pragmatic classroom, structures and routines in the classrooms, techniques to facilitate symbolic thoughts (Rogers & Lewis, 1989). Unlike the previous programs reviewed, the DHSCP is developmentally oriented and is based of Piagetian theory rather than applied behavior analysis. The day treatment program is delivered to each child for 22 hours per week during the course of 12 months. Each classroom has a teacher/aide to child ratio of 2:1 (Gresham et al., 1999) (see table 4 of DHSCP Empirical Studies).

Review of Denver Health Sciences Centre Program Empirical Studies (DHSCP)

Four empirical studies have demonstrated the efficacy of the DHSCP program. Rogers et al., (1986, 1989) revealed significant gains in areas of cognition, language, social/emotional, and perceptual/fine motor skills, social/ communicative, play skills. The cognitive complexity of their play skills increased also in areas of symbolic complexity, symbolic agent, and symbolic substitutions. Rogers et al., (1987) showed significant positive changes in the five developmental domains: perceptual, fine/gross motor skills, social/emotional, self-care. Rogers and Dilalla (1991) found that children with autism when matched on initial age and developmental level with the comparison group, the group with autism was found to achieve the same rate of progress on various measures of development during intervention as the non-autistic group. However, like all programs reviewed in this article, the empirical research on this program suffers from most of the same methodological flaws. In spite of these strengths that mentioned above, the HSCP cannot be considered a well-established or probably efficacious treatment for children with autism in light of the Division 12 Task Force criteria (Gresham et al. 1999). Further studies needs to compare the effects of the HSCP on these particular groups of children**.**

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Table 4. Denver Health Sciences Centre program (DHSCP) Empirical Studies

Author & Year	Sample	Age	Instruments	Intervention	Findings
1) Rogers et al. (1986)	26 Childre with autism	47.92 months	EIDP; POS; PCIT	DHSCP	Increased: cognition, perceptual fine motor skills, and social, emotional, language skills. Play skills increased in: symbolic complexity, symbolic agent, and symbolic substitutions; Changes: social/ communicative play skill.
2) Rogers et al. (1987)	11 children with autism	56 months	EF; OM;PM; POP; POS	DHSCP	Significant subjective perception of: value, utility positive changes: perceptual/fine motor, social/emotional, gross motor, self-care, play, social emotional, language, structure, unwanted behaviour skills.
3) Rogers & Lewis (1989)	31 children with autism	44,68 months	EIDP; POS; CARS; Parent child play	DHSCP	Increased: cognition, perceptual fine motor skills, and social, emotional, language skills. Play skills increased in: symbolic complexity, symbolic agent, and symbolic substitutions; Reduction of autistic symptomatology.
4) Rogers & Dilalla (1991)	76 children with autism	45.77 months	IQ; MAT EIDP; CARS; LQ	DHSCP	Group with autism achieve: normal developmental rates during the enticement period of treatment; The same rate of progress on various measures of development during intervention as the non-autistic group.

Notes for instruments of table 4 of Denver Health Sciences Centre program ((DHSCP)

ADI-R= Autism Diagnostic Interview-Revised; ADOS; Autism Diagnostic Observation Schedule; MSEL= Mullen Scales of Early Learning; VABS= Vineland Behavior Scale; RBS= Repetitive Behavior Scale; MSEL: Mullen 1995= Mullen Scales of Early Learning; ADOS – G; Autism Diagnostic Observation Schedule-G; SCQ= Social Communication Questionnaire; VABS-II= Vineland Adaptive Behavior Scales Second Edition; FOI= Fidelity of implementation; Child Behavior Rating Scale (CBRS); LS= Likert-scale

Early Start Denver Model ((ESDM).

In 2003, the Early Start Denver Model was developed by Sally Rogers and Geri Dawson to address the needs of toddlers with ASD and their families for parent involvement and intensive intervention. The ESDM is a manualized, comprehensive early behavioral intervention for toddlers to pre-school children with Autism Spectrum Disorder (ASD) that integrates Applied Behavior Analysis with developmental and relationship-based-approaches (Dawson et al. 2010). The ESDM is designed for children with ASD aged from 12 months to preschool age (Eapen et al., 2013). The intervention is provided in a toddler's natural environment and is delivered by trained therapists and parents (Dawson et al., 2010). Learning objectives focus on individual strengths and weaknesses. Also focus on developmental domains that are foundational to social learning and social-cognitive development, including verbal and non-verbal communication, joint attention, play, social orienting, imitation, and attention (Vivanti et al., 2014) (see table 5 of ESDM empirical studies).

Review of empirical studies of Early Start Denver Model (ESDM)

Vismara et al., (2008) along with the following study of Vilmara, Colombi, and Rogers (2009) showed that developmental progress in important social communicative behaviors can be achieved by teaching parents well specified tactics. Dawson et al., (2010) studied the first randomized, controlled trial of intervention and showed that children in the ESDM group made significant improvements in IQ, adaptive behavior, receptive and expressive language, communication, daily living and motor skills. A strong ingredient for this success was that parents used these strategies (Dawson et al., 2010).

The first community effectiveness controlled study of ESDM was that of Vivanti et al., (2014). Both Vivanti et al., (2014) and Eapen et al., (2013) indicate that the ESDM have positive effects on developmental rates and receptive language of young children in the context of community based group settings, in cognitive skills, social communication and adaptive functioning. Similar results were found in the study of Dawson et al. (2010). Eapen et al., (2013) found significant results particularly in the areas of receptive language and communication (Eapen et al., 2013).

Autism for the United States costs 35$ billion per year as the prevalence is 1 per 150 (Dawson et al., 2010). Studies that based in the community group of the ESDM early intervention for children with ASD could be cost effectiveness (Eapen et al., 2013).

Table 5. Early Start Denver Model (ESDM) Empirical Studies

Author & Year	Sample	Age	Instruments	Intervention	Findings
1) Vismara et al. (2008)	1 infant (at 18 and 24 months diagnosed with autism)	9 months	MSEL; ADOS; CBRS; ESDM; Fidelity Scale	ESDM	Parents showed improvement in: technique use on a variety of interactive, communicative, and teaching skills that foster attention, positive affect, imitation, and communication; Significant increase by the fifth to sixth week of coaching; Children demonstrated sustained change and growth in social communication behaviors.
2) Vismara et al. (2009)	8 children with autism	10-36 months	FOI; CBRS; LS	ESDM	Parents showed improvement in: technique use on a variety of interactive, communicative, and teaching skills that foster attention, positive affect, imitation, and communication; Significant increase by the fifth to sixth week of coaching; Sustained change and growth in social communication behaviors.
3) Dawson et al. (2010)	48 children with autism	18-30 months	ADOS;MSEL; VABS; RBS	ESDM	ESDM group: improvements in IQ, adaptive behavior, receptive and expressive language, communication, daily living and motor skills; After the 2nd year: autistic diagnosis retained for ESDM group: 56% and for Community intervention group: 71%
4) Eapen et al. (2013)	26 children (21 male) with autism	49.6 months	MSEL: Mullen 1995; SCQ; VABS-II	ESDM	Improvements: on visual reception, receptive language and expressive language scales of the MSEL; Parents reported increase in child's receptive communication and motor skills on the VABS-II and a significant decrease in autism-specific features of the SCQ.
5) Vivanti et al. (2014)	27 preschoolers with autism	18-60 months	ADOS – G; MSEL: Mullen 1995; VABS	ESDM	ESDM group: greater gains in developmental rate and receptive language as compared to the comparison group; No results in symptom severity in either of the groups; Gains for the both group in: cognitive skills, adaptive functioning, and social communication.

Notes for instruments of Table 5 of Early Start Denver Model (ESDM)

ADI-R= Autism Diagnostic Interview-Revised; ADOS; Autism Diagnostic Observation Schedule; MSEL= Mullen Scales of Early Learning; VABS= Vineland Behavior Scale; RBS= Repetitive Behavior Scale; MSEL: Mullen 1995= Mullen Scales of Early Learning; ADOS – G; Autism Diagnostic Observation Schedule-G; SCQ= Social Communication Questionnaire; VABS-II= Vineland Adaptive Behavior Scales Second Edition; FOI= Fidelity of implementation; Child Behavior Rating Scale (CBRS); LS= Likert-scale.

Discussion

This study reviewed five treatment programs: ABA, TEACCH, LEAP, DHSCP, and ESDM. ABA and TEACCH are among the most widely known comprehensive treatments (Gresham et al., 1999).

Most of the studies revealed positive results in language, adaptive, cognitive and educational outcomes but in the most of them have been lacked even the most basic features of scientifically sound studies, such as an experimental or quasi experimental design, reliable assessments, and replicable descriptions of the treatments that children received. Also most of the studies have weaknesses such as a small group sizes and therapists who had minimal training and experience.

Despite all these limitations, the Lovaas study and more specifically the USLA, a more naturalistic behavioral treatment, yielded the most significant results with the strongest methodology. The effects of the USLA model have been the most rigorously documented of any treatment model for children with autism. While a small minority of professionals still denies the efficacy of these methods, the vast majority of researchers who have examined the evidence are of the opinion that improvements occur in varying degrees for all children who participate (Matson et al. 2012).

The other studies, TEACCH, LEAP, ESDM and the HSCP have been unable to duplicate results consistent with those that Lovaas has shown in his individual study. LEAP strategies are not only effective but also efficient in producing wide-scale behavioral change (Stain & Bovey, 2011). Eikeseth et al., (2009) who evaluated studies of TEACCH and Denver Model, indicated that interventions based on ABA will be considered 'Well Established' and TEACCH and Denver Model will be considered as neither 'Well Established' nor 'Probably Efficacious'. Despite evidence there is no clear answer regarding the most effective therapy to improve symptoms associated with ASD. The greatest buzz by far has centred on early intervention (Reed et al., 2007; Matson et al., 2012).The majority of the studies was that of Lovaas but it remains to be determined if any one early and /or intensive intervention program is more effective than another (Ospina et al., 2007). Callahan et al., 2010 suggested that parents, administrators and special educators favor using a combination of ABA and TEACCH.

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Conclusion

It is conceivable that, at some time in the future, diagnosis of autism will be sufficiently sophisticated to include specific recommendations for treatment. In other words, it may be that some children will be prescribed an ABA –based approach, or LEAP approach or TEACCH, or HSCP, or ESDM or some specified combination of these treatments. This study reviewed five treatment programs ABA, TEACCH, LEAP, ESDM, and DHSCP and although they showed positive results in many studies and all of these studies have proven effective in many settings in the classrooms, there needs to be more research. ABA it is the only method of instruction which has shown consistent empirically supported improvements in the core deficits of the disorder. It's a field that needs to be more research. This review of the literature it has proven that there is no cure for autism, nor is there a single correct approach for all children with autism.

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